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Vol. XXIX No. II A PUBLICATION OF THE LEONARD HILL TECHNICAL GROUP NOVEMBER, 1958



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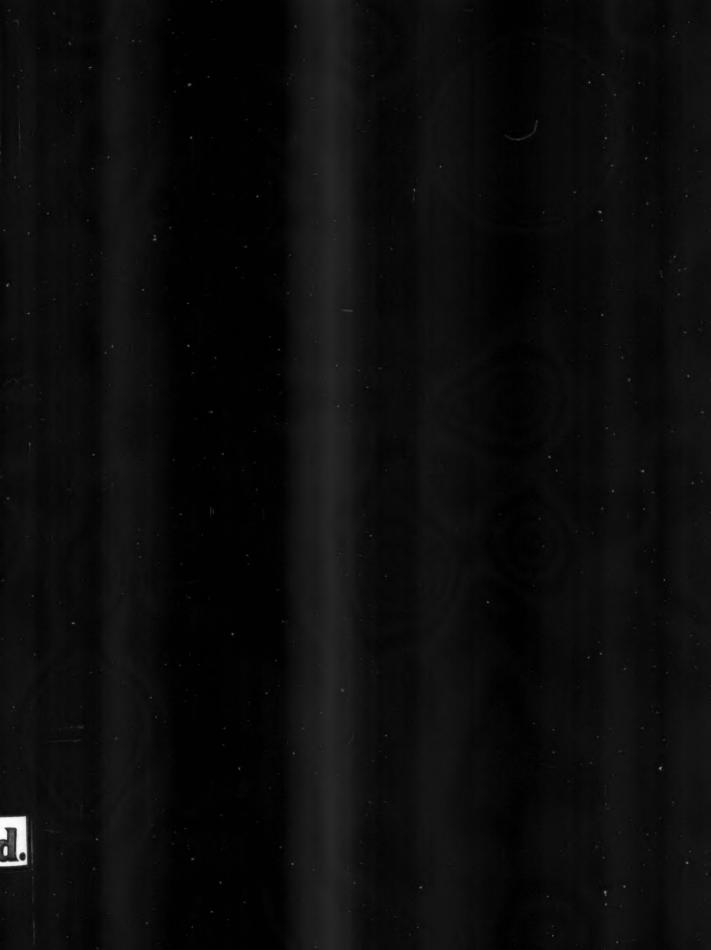
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	*		-		
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Bencard, C. L., Ltd	_			-	Sept.
				A14	AIIO
					Oct.
			-	-	A54
Bramigk & Co. Ltd				-	A97
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	*	-			AIII
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			-	-	Oct.
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Bush, W. J., & Co. Ltd.			-	-	A67
Butterfield, W. P., Ltd.			-		A69
Caller Lad					4.4
Calfos Ltd	1				A4
Cambridge Instrument Co.	Ltd.		-		Oct.

						Page
Carless, Capel & L	eonard	Led.	-			A90
Carlson, John C., Chemapol -	Ltd.					Oct.
Chemapol -						A45
Chemicals & Feeds	Ltd.					A108
Chilean Iodine Edi	ication:			-	-	A98
China National Im	port &	Expo	rt Co	orp.	-	A99
Christensen, Lars			*			Sept.
Clark, Geo. & Son	s (Hull) Ltd.	-	-	-	A53
Clark, T. & C. Ltd				-		AIOI
Clarke-Built Ltd.					-	A58
Classified Advertise	ments	*	*		AII	3-A114
Coalite & Chemica	I Produ	ucts L	td.			A68
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Edwards High Vacu	um Lto	d.				ALL
Electrothermal Eng	ineerin	g Ltd	. *			A70
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				Page
Foster, Yates & Thom Ltd.			- C	over 2
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Fritsch, Rudolph, W	-			A109
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Kemball, Bishop & Co. Ltd.	-			
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Manlove Alliot & Co. Ltd			-	A31
Manning, A. J., Ltd				AIII
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Martindale Electric Co. Ltd.				Aug.
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Mason & Morton Ltd May & Baker Ltd		-		Oct.
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Metal Closures Ltd	-			over I
Metal Hydrides Inc				A86
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Mischall I A Isd	-		-	A102
Mitchell, L. A., Ltd Mono Pumps Ltd				Oct.
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Morgan Fairest Ltd	-		-	Oct.
Moritz Chemical Engg. Ltd.	-			A104
Morson, Thomas, & Son Ltd.	-	-	-	A82
National Glass Work (York) I	.ed.			A38
Olley, C., & Sons Ltd	-	-		Oct.

					Page
Page, Chas., & Co. Ltd.					ALIZ
Palfrey, Wm. Ltd	-	-		-	A5
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Paterson Engineering Co.	Ltd.				Oct.
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recrochemicals Ltd	-		-	-	A16
Pharmaceutical Press, The	-			-	A96
Plastic Closures Ltd	-	-		*	Oct.
			-	-	A46
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Rexolin Chemicals -			-	-	Oct.
-Rhone-Poulenc, Soc. de U	sines	Chi	miques	-	A3
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Roche Products Ltd			-		Oct.
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Rockwell Pneumatic Scale	Ltd.	-		*	Oct. A106
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Roussel Laboratories Ltd.		•		•	VOI
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Scandinavian Scherer, R. P., Ltd Service Electric Co. Ltd.	*	-			A63
Scherer, K. P., Ltd	-	-	-	~	Oct.
Service Electric Co. Ltd.	-	-	-	-	A78
Shandon Scientific Co. Ltd		-	-	-	A82
Shell Chemical Co. Ltd.					AID
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Simpson, vv. 5., & Co. Ltc					ALIZ

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Sipon Products Ltd.			-			Alge
Smith, T. & H., Ltd.			-	-	-	A24
Smiths Industrial Ins	t. Di	v.	-	-		A5S
Southern Apparatus	Co.	Ltd.	-	-	-	A74
Standard Synthetics			-	-	-	Oct
Staveley Iron & Cher	mica	Co. L	.td., '		-	A47
Steel, J. M., & Co. L.	td.					AIO
Stephens Bros. & Bar	nner	Ltd.			-	A84
Sturge, J. & E., Ltd.	-	-				A39
Sturtevant Engineeri	ing C	o. Ltd	1	-		Oct.
Sutalite Ltd	*			-		A107
Sutcliffe Speakman &	Co.	Ltd.		•	-	A103
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Tennants (Lancashire	Le	d.				A109
Thames Board Mills I				-	-	A50
Thermocontrol Instal			1.	-	-	A72
Thompson & Capper			-			A62
Trade Agent for Mys	оге	-	-	-		A107
Trade Commissioner	r for	the	Britis	h W	est	
Indies, British Guia						Oct.
Tungstone Products	Ltd.		-	-		Oct.
Tye, John, & Son Ltd	1.	*	*	•	*	AI8
Ultrasonics Ltd.			-			Sept.
Union Carbide Ltd.	*	-				Oct.
United Glass Bottle I	Manf	rs. Ltd	1.		- (Cover 3
United Indigo & Che	mica	I Co. I	Ltd.		-	A112
Universal Metal Prod			-	-	~	Oct.
Universal Oil Co. Ltd						A73
Universal Packing Ca	se C	o. Ltd			•	Aug.
Venesta Ltd						Sept.
Viscose Development	Co.	Ltd.	-	-	-	Oct.
Vitamins Ltd		*		•		A80
Warwick Production	Co.	Ltd.				A4I
Watson, W., & Sons	Ltd.		-			Oct.
Weatherfoil Heating	Syst	ems Li	td.	-	-	A49
Weddel Pharmaceutic						Aug.
Welch, J. A. (Plant &				-		A65
Westbrook Lanolin C				-	-	Oct.
Whaley, The, Bridge						Alti
White Sea and Baltic	Co.	-				011A
Willcox, W. H., Co.	Ltd.			-	*	A44
Woodhams, Dade &			-		*	A108
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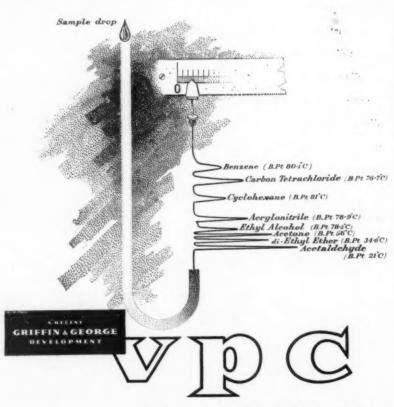
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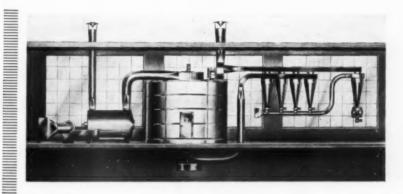
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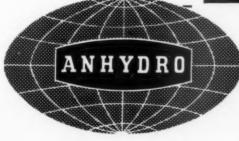
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November, 1958—Manufacturing Chemist

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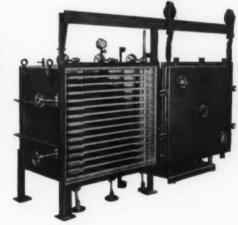
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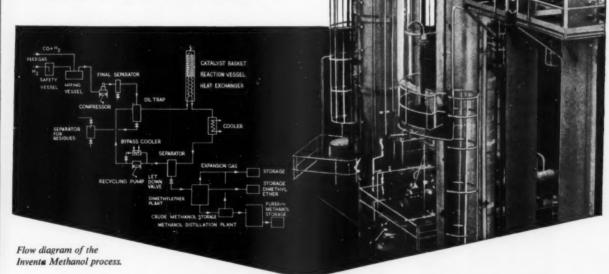
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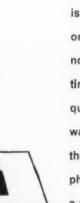


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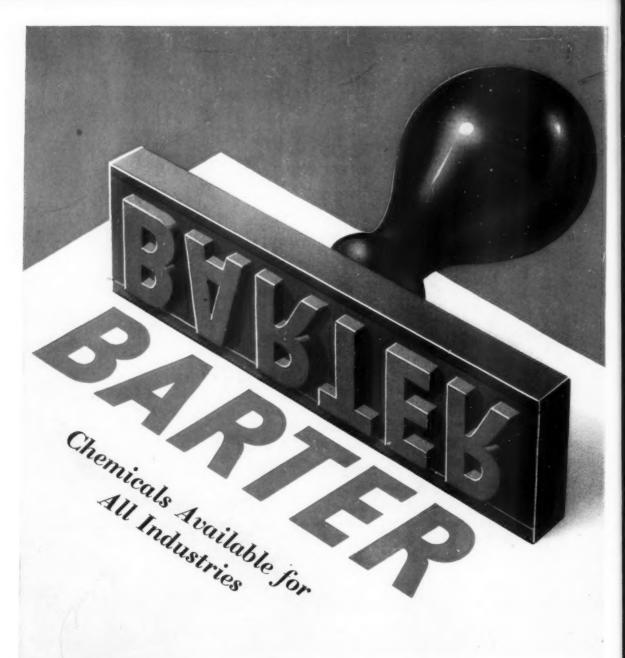
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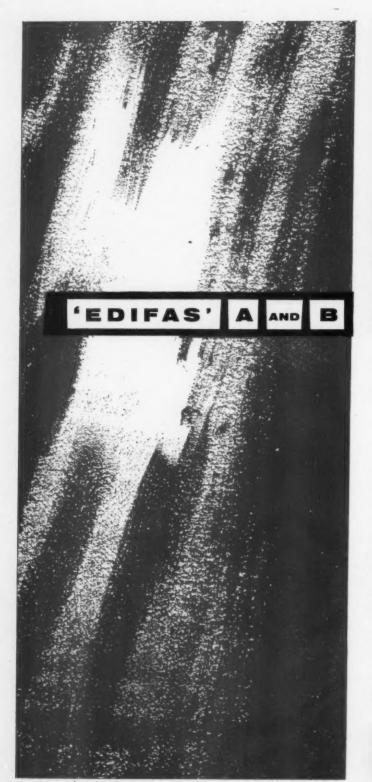
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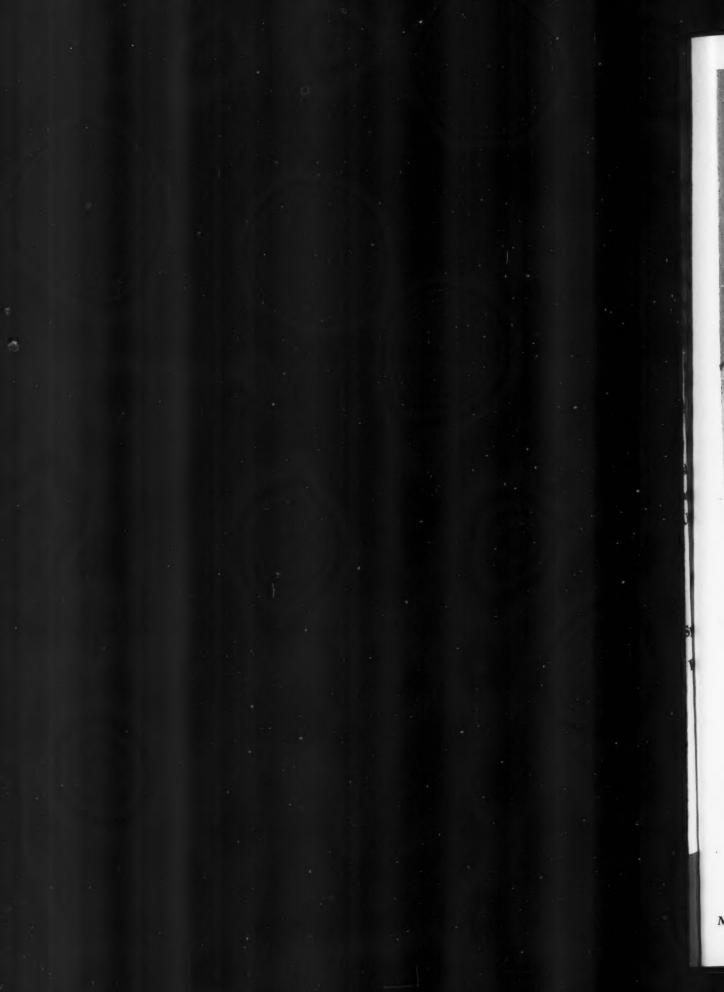
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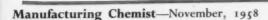


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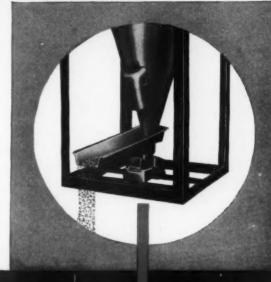
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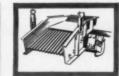
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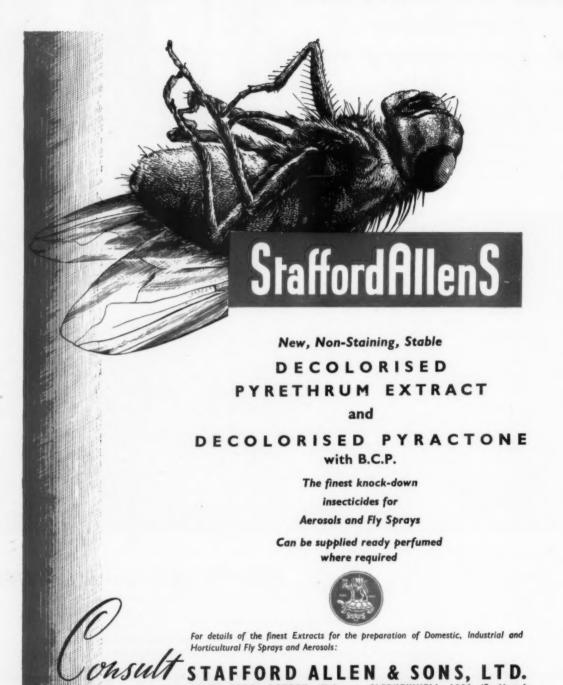
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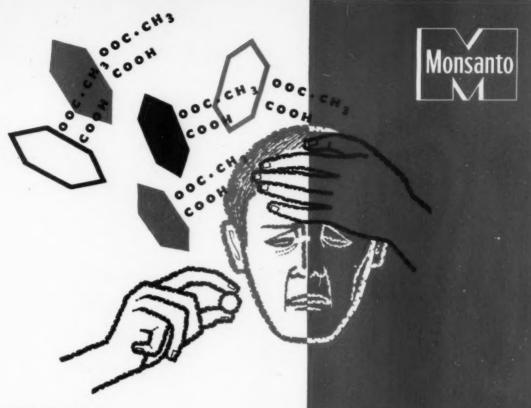
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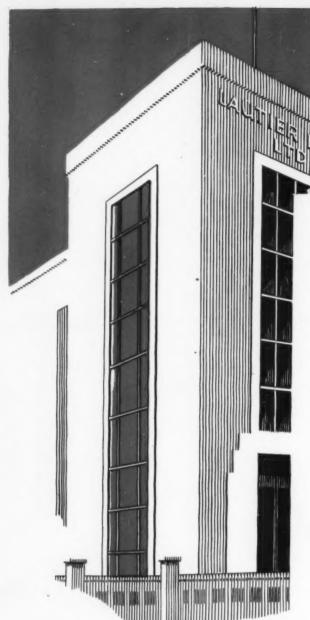
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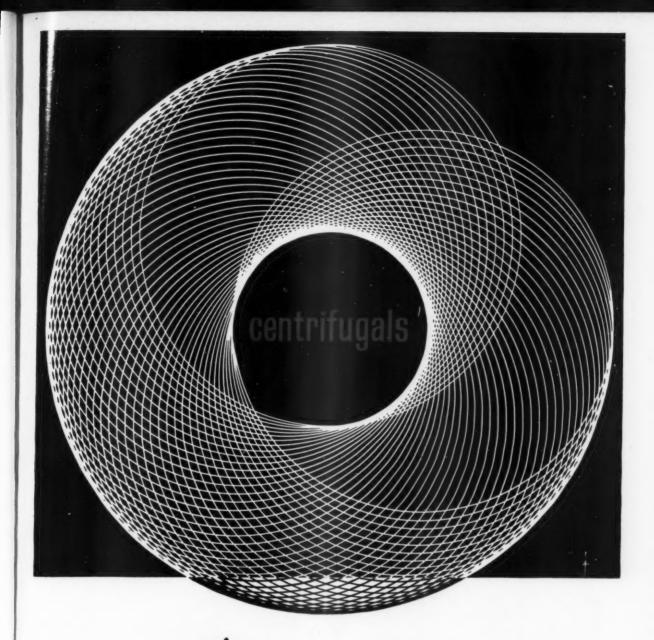
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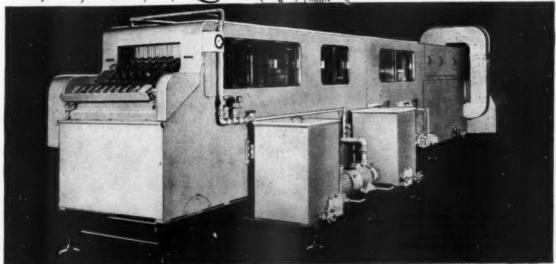
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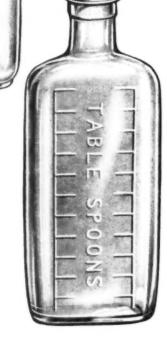
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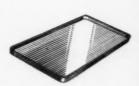
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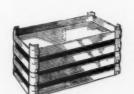






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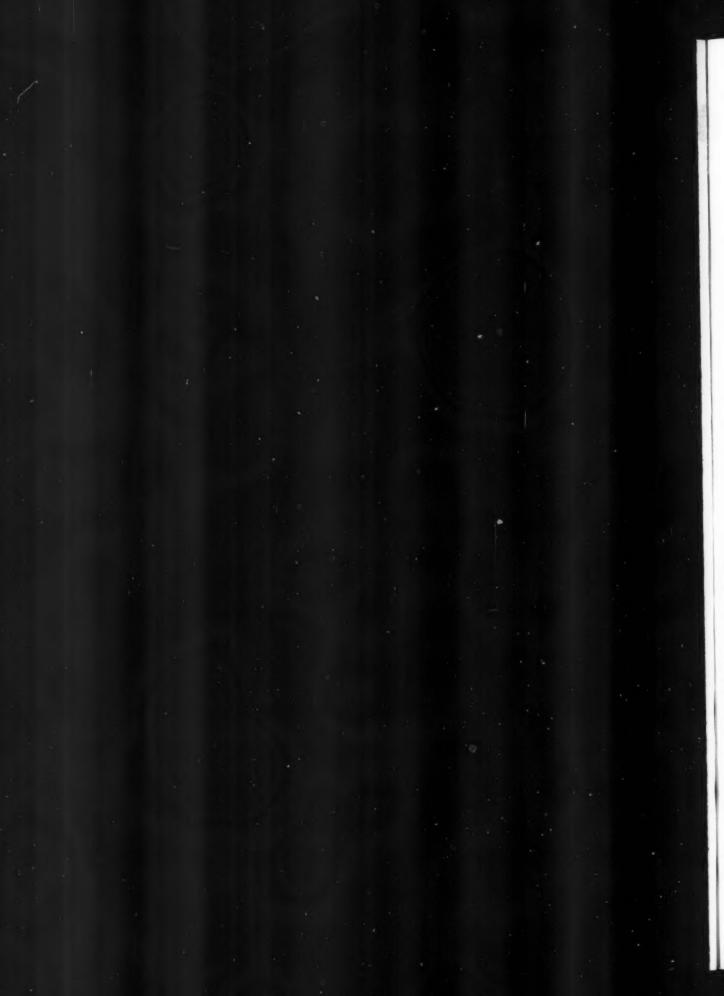
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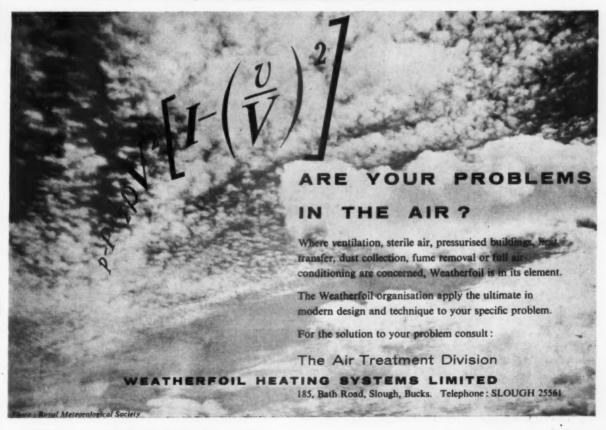
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Vol. XXIX, No. 11	Con	tents NOVEMBER	, 1958
Topics and Comments: Paying for drug trials; Import rationalisation; Glamour plus hygiene; Where chemical engineers work; New era at Boots; Electronic reading; Hot snakes; Chloroform controversy; Gold-plated wonder.	451	Speedy Handling at Boots' New Warehouse Synthesis and Applications of Acyl Halides—2 By Greville Machell, B.SC., PH.D., A.R.I.C.	471 473
Pharmaceutical Development—the Link Between Research and Production By N. J. Van Abbe, F.P.S., M.INST.PKG.	455	Progress Reports: Perfumery and Essential Oils By G. B. Pickering, M.A., D.PHIL., A.R.1.C.	476
Chemical Wealth from Sugar By E. T. Dewar, PH.D. Drying Plant and Equipment for a Variety of Tasks	458	Disinfectants and Disinfection By A. H. Walters, F.I.M.L.T., M.R.S.H., M.I.BIOL.	479
Cosmetic Science at German Congress	469	Cosmetic Society's Aerosol Symposium	482
REGULAR FEATURES: PLANT AND EQUIPMENT NEWS 487 • PEOPLE 489 • PACKAGING 4 CHEMICAL MARKET 494 • NEW COMPANIE	91 • ES 496	BOOK REVIEWS 485 • NOTES AND NOTION NEWS FROM ABROAD 492 • NEW PRODUCE NEW TRADE MARKS 497 • NEW PATE	CTS 493

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TOPICS AND COMMENTS

Paying for drug trials

THE ARRANGING of clinical trials for a new drug is a matter which can easily cause disagreements between drug manufacturers and doctors. On the one hand the drug manufacturer may be suspected of unworthy commercial motives, and on the other the doctor is anxious to conform strictly to the ethics of his profession. While in this country both sides have avoided the excessive commercialism which throws doubt on clinical trials in other countries, it is clear that there are many aspects of the present situation about which both sides are unhappy. Pfizer Ltd. are to be commended for arranging a symposium on clinical trials at which these disagreements were brought into the open. The symposium was held earlier this year at the Royal Society of Medicine under the chairmanship of Sir Charles Dodds and was attended exclusively by medical men. Nine papers were given covering technical as well as ethical aspects of clinical trials. These and the accompanying discussions have now been published by Pfizer in book form.

The financial aspects of clinical trials were discussed by Prof. A. Kekwick of Middlesex Hospital. He considered three types of trials. The first is where the pharmaceutical house simply wants to know whether its product is better or worse than others, whether it is complementary to existing products, and so on. The difficulty arises when publication of the results is requested. This, in Prof. Kekwick's view, is something quite different from the original request and pharmaceutical houses should not seek to impose this obligation as a condition of payment. The fee should be paid to the institution doing the trials and not to individuals.

The second type of trial is where the opinions of general practitioners are sought as to whether the product is the sort suitable for general practice. Here the doctor might lay himself open to the accusation that he is experimenting on his patients. Prof. Kekwick thought that consumer trials of this kind should not be done for a fee unless the arrangements are made through an official body like the College of General Practitioners or the B.M.A.

The third type of trial was sometimes called the promotional trial. The pharmaceutical house seeks the opinions of eminent doctors on a drug—perhaps already well known—recommended for the condition in which the doctors specialise. The motive is publication of results under the names of eminent men. Prof. Kekwick thought this kind of trial quite undesirable and one which should cease.

Not everyone will agree with Prof. Kekwick's definitions and strictures. Clinical trials are obviously necessary and the pharmaceutical industry must be able to quote the names of reputable doc-

tors to substantiate claims for a drug. As for the promotional aspects, no one would accuse a body like the Medical Research Council of commercial bias, yet when they carry out an investigation and find in favour of a particular drug their report must help the manufacturers of that drug.

Clinical trials are only one aspect of a bigger problem, that of the ethics of clinical research as a whole. This in turn is part of the vast problem of keeping doctors properly informed of medical advances while avoiding the distortions of commercial exploitation.

Import rationalisation

AT MIDNIGHT on December 31, 1958, a new Customs and Excise Tariff will come into force. To many importers of chemical products it will be particularly welcome because of the clear and straightforward manner in which the rates of duty, drawbacks, and allowances on imported products are set out.

The present Tariff is a complex mass of legislation ranging from that part of the Schedule to the Customs Tariff Act of 1876 which related to figs, fig cake, plums or raisins to the emergency legislation introduced during the last war. It includes such important landmarks as the Safeguarding of Industries Act, which in 1921 gave a measure of protection to the synthetic organic and fine chemicals industry, and the Import Duties Act of 1932, by which the United Kingdom abandoned her nineteenth-century tradition of Free Trade and instituted that system of Imperial Preferences which has been of such assistance in establishing the Commonwealth as the great trading partnership of the world.

By the Import Duties Act of 1958 all of this legislation was repealed and the Board of Trade were given powers to issue a new Tariff. The advance edition of this document is now available and reveals the immense amount of work, extending over several years, which has been necessary in its compilation. While the principles of the existing legislation have been retained, some marginal adjustments in rates of duty have been found necessary owing to the altered basis of the new Tariff.

The new arrangement of the Tariff is based on the system known as Brussels Nomenclature, which provides a systematic classification for all goods entering into international commerce. It consists of 21 sections subdivided into 99 chapters and 1,095 headings. The tariffs of most countries of Western Europe will eventually use this system and it is expected that many other countries will follow suit in due course. The comparison of tariff rates for different countries will thus be made immeasurably more simple than the complicated exercises which are at present necessary.

Chemicals and allied products are dealt with principally in Sections VI and VII of the Tariff which cover chapters 28-40 inclusive. Chapters 28 and 29 are concerned with individual organic and inorganic chemicals, and chemical importers will be greatly helped in their task of allocating their chemical imports to the correct category by a handbook issued by Customs and Excise ("Classification of Chemicals in the Brussels Nomenclature, 1958"; H.M.S.O.; 8s. 6d.). This publication lists some 10,000 chemical products under standard nomenclature based on British Standard 2474 and indicates their correct headings in the new Tariff.

The majority of organic and fine chemicals in the new Tariff will be listed at $33\frac{1}{3}\%$ duty as provided for under the Safeguarding of Industries Act. However, the temporary exemption procedure will continue to operate as at present. The major difference is that where such a material is not available from United Kingdom sources it may be imported free of all duty instead of paying 10% ad valorem as is now the case.

The new Tariff is a long delayed measure of simplification and rationalisation which will be particularly welcomed by all importers of chemicals.

Glamour plus hygiene

RESEARCH may have turned the perfumery wheel full cycle. It is a good many generations since the primary function of perfumes was to mask the odours of everyday life. Their modern use has passed into the realm of luxury, vanity, charmcall it what we will. Now a report from the biology department of the University of Long Island, U.S.A., attributes to many perfumes, notably some of the commonest, antiseptic properties. This is not just a re-statement of the fact that the alcohol used in most perfumes has some antiseptic value. oils themselves can be antibacterial or antifungal. About 100 aromatic oils used in perfume manufacture were tested against fungi and bacteria. All exhibited antibacterial activity against at least two of the ten bacteria in the tests. The score for antifungal activity was rather better; this was displayed against at least six out of ten fungi used in the tests. Among perfume oils with measurable antimicrobial activity were lily of the valley, lavender, jasmine, lilac, wistaria, orange blossom and sweet pea.

It is argued that toilet preparations such as soaps, face creams, lotions and shampoos will have some antiseptic properties if they contain perfume oils. We are not informed as to how powerfully antibacterial or antifungal the perfume oils are, but we can certainly foresee great activity in the advertising field. "Sandra never seems to catch a cold—no, she uses Soir de X, it makes her lovelier than ever and kills germs too." Putting glamour on a hygienic basis has intriguing potentialities.

Where chemical engineers work

IN SPITE of the endless publicity given to the subject and the action of certain firms in providing post-graduate training, the importance of having a large and well-trained force of chemical engineers is still not properly recognised by industry in general. The suspicion of ignorance and apathy seems to be confirmed by the Institution of Chemical Engineers' latest report on the supply and distribution of chemical engineers, and indeed the possibility is raised that the failure of some industries to appreciate their chemical engineering needs is the reason why the 1956 Report on Scientific and Engineering Manpower did not give a much larger figure than the 2,200 suggested as the total number of chemical engineers required by 1959. The Institution's own estimates indicate that there is no room for complacency.

The Institution has analysed its membership in terms of employment in 1957. In making a comparison with a similar survey carried out in 1953, and making allowance for the more refined methods of analysis used in the 1957 survey, it appears that there has been some increase in the proportion of members employed in administration (1953=20%, 1957=30%) and a decline in the proportion engaged in plant operation (1953=23%, 1957=12%).

Compared with the latest known figures for the U.S.A. (31%) the percentage employed on research and development is low (23%), while the percentage employed on design, construction, installation and commissioning is high—21% against 7% in U.S.A.

In examining the distribution of its members throughout Britain, the Institution finds that the regions with the largest population of chemical engineers contain also the greatest concentration of them—concentration being defined as the number of chemical engineers per 1,000 male adults employed. The shortage of chemical engineers cannot be solved by concentration on a few regions.

The greatest concentration of chemical engineers is in mineral oil refining, which is estimated to have 236 chemical engineers compared with a total number of men workers of 32,210. Next come the "Chemical and allied trades" with 806 chemical engineers amidst 342,430 workers. Further down the list come textiles (56 chemical engineers, 50,790 workers), the gas industry (60: 121,950), nonferrous metal manufacture (21: 96,550) and food, drink and tobacco (72: 471,970).

Obviously the mineral oil industry has been more successful than others in building up an adequate corps of chemical engineers. It is also interesting to note that the atomic energy industry showed the sixth largest number of chemical engineers, with 90 returns from Institution members in atomic energy against 257 in chemical plant manufacture, 189 in mineral oil refining, 124 in heavy inorganic chemicals, and 104 in fine chemicals and pharmaceuticals, out of a total number of 1,724 returns.

New era at Boots

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Lectronics will take one of their biggest strides yet in industry and commerce when Boots Pure Drug Co. Ltd. begin using an electronic reader and computer next summer. The reader will automatically read figures and characters from till rolls and feed the information into a calculator which will give various analyses of cash receipts far quicker than the keenest human brain and deftest human hand. The reader is aptly called the Era (electronic reading automaton) and indeed it heralds a new cra in which thousands of office workers will be freed from the tedium of routine book-keeping and elerical work.

Simultaneously with this remarkable innovation, in which they lead the whole world, not excluding Russia and America, Boots will turn over the stock-keeping of the 60,000 items they carry in their ware-houses to an Emidec electronic computer. It will keep a perpetual inventory and show immediately how stocks of each item vary with orders from branches. Warnings will be given automatically whenever stocks fall below a critical level. Analysis of these fluctuations will give Boots the chance of gearing their own factory production schedules to the electronic brain.

People with fanciful imaginations will see in all this the subjugation of the human mind to machines. But both Era and Emidec are slaves, dependent entirely upon the ministrations of men and capable only of doing what their masters wish. In fact they represent a long step in the process of freeing men from mental drudgery just as power machines free their muscles from hard work.

Electronic reading

How has it been possible to imitate the actions of that most wonderful of all human organs, the eye? First let it be noted that Era's eye is limited in its vision and has to have special type for the matter it reads. Boots are providing this with completely new cash registers designed for them by a Norwegian firm. A thousand have been ordered and 5,000 more will follow before all Boots' 1,300 branches are equipped.

Era will read the till rolls by scanning each item (average 7 characters) with a quickly moving pencil of light shot from a cathode ray tube. The variations in white and black encountered by the light will be converted into electrical signals by a photomultiplier tube. The electrical picture of the figure or letter will then be impressed on an electric store, after which special circuits will identify the character and pass the information to a calculator. This further essay in electronic wizardry will then perform the various analyses needed for the central administration of the vast distribution network, which sells 70,000,000 items a year.

A company with an accounting problem like this certainly needs all the help it can get, electronic or otherwise, and it is to be hoped that Boots will get a good return for the £1,250,000 they are spending on their electronic revolution.

Emidec will automatically sort the branch orders—which may amount to 300,000 items a day—into the sequence in which they are stocked in the warehouse to facilitate the job of assembling them for dispatch. It will print out a duplicate order/invoice, one copy of which will go to the branch manager to compare movements of stock with his weekly takings. Items out of stock will be "memorised" by the computer and supplied as soon as they come in.

The snag in the system so far is the need to hand punch branch orders on to the tape that feeds the computer. Much time could be saved if some such device as Era could translate the orders for the computer and feed in the information direct. Better still would be the linking of the till roll reading operations with Emidee's stock-keeping. If this were done a sale clicked up on a cash register in Croydon could be the means of re-ordering the product from a warehouse in Nottingham.

This may come one day. Meanwhile the whole business world, not just the pharmaceutical industry, will be fascinated to see how Boots are rewarded for the courage and hard work they are putting into the re-shaping of distribution and production.

Hot snakes

THE LATEST and possibly the most bizarre application of radiochemicals is to the study of snake venom. Prof. Joseph Gennaro of the University of Florida medical school began to use sodium radio iodine (I131) to find out how snakes make and secrete venom. He uses one of the most vicious species-the cottonmouth moccasin. He gave the reptiles 30 microcuries of I131 by intraperitoneal injection 24 and 48 hr. before they were killed. Some were also given a five-day course of thyrotropin. To encourage the snakes to make poison they were not fed and the combination of hunger and thyroid injections made them very badtempered customers. Fortunately the professor and his assistants learned snake handling. Snakes that received the thyroid hormone had 17 times as much radioactivity in their venom as the others.

Snake venom contains many different materials, including salts, fats, carbohydrates and proteins. Of these the poisonous fractions are all considered to be proteins. Crotoxin and crotamine are generally regarded as the poisonous principles of the viper venom.

Prof. Gennaro's next object is to study the effects of snake venom. He will inject poison labelled with I¹³¹ into animals to study its dissemination rate and sites of distribution. These experiments, according to a note in *Industrial and Engineering Chemistry*, may result in better antidotes to snake bites.

Chloroform controversy

ALTHOUGH Liebig is generally credited with the first preparation of pure chloroform some people attribute this achievement to a lesser known chemist, Eugène Soubeiran. The centenary of Souberein's death—he died in his native city of Paris in 1858, aged 61-provides an occasion to remedy the deficiencies of his biographers. First he was chief pharmacist at a major hospital and then director of the central pharmacy serving all the Paris hospitals. He then went to be professor at the École de Pharmacie. A member of the Academy, he wrote notable texts on pharmacy and on applications of botany in pharmacy; he wrote a manual of pharmaceutical theory and practice and was responsible for a French pharmacy codex as well as dictionaries of industrial pharmacy and of practical medicine.

Samuel Guthrie's preparation of chloroform in "a clean copper still" using 3 lb. of chloride of lime and "two gallons of well-flavoured alcohol" was simply the preparation of a solution of chloroform in aqueous spirit. Guthrie did suggest redistilling to obtain a more concentrated solution, but he did not use sufficient water in the first operation. Moreover, his solution of chloroform in alcohol was more of a quack remedy or means of producing "a lively flow of animal spirits and loquacity" as he and his friends themselves experienced at parties.

In 1831 Liebig at Giessen and Soubeiran in Paris independently discovered the true preparation of chloroform as an organic compound rather than as an alcoholic solution for use at "chloroform parties." Liebig was studying the action of chlorine on alcohol when he obtained first chloral hydrate, then liquid chloral, a product he found to be decomposed by solutions of alkalies into a formate and a new chlorine compound, one which was also formed in quantity by distilling alcohol with chloride of lime. This preparation was summarised in the same issue of the Annales de Chimie et de Physique for October 1831 that included Soubeiran's full paper on what he called "Ether Bichlorique," a liquid he obtained by heating a concentrated slurry

it over calcium chloride, and re-distilled it to yield a liquid "of pleasant odour and sweet taste." In contrast to Liebig's belief that chloroform was a chloride of carbon, the French chemist also noted the combined hydrogen, a step towards the true formula assigned by Dumas in 1834.

Soubeiran described his preparation to the Academy in October 1831, and further described

of bleaching-powder with alcohol. Soubeiran washed his chloroform with water to remove alcohol, dried

Academy in October 1831, and further described his work in the *Journal de Pharmacie* in December of that year. Liebig gave his accounts in Poggendorff's *Annalen* in November 1831 and February 1832, as well as in his own *Annalen* for February. As with other discoveries there arose claims by different writers for priority for Soubeiran or for

Liebig, according to their prejudices. Liebig claimed priority and went so far as to assert that in November 1831 Soubeiran had no knowledge of "Ether bichlorique." Thanks to the studies of Dr. L. Dobbie of Edinburgh and Dr. M. Speter of Berlin the matter was cleared up and a slight priority was established for Soubeiran. Dr. Speter found that an abstract of the paper Soubeiran presented before the Academy had appeared in the Paris publication, La Lyeée, in October 1831.

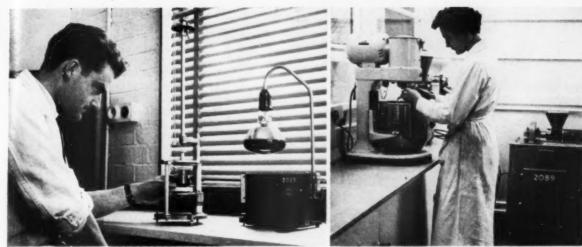
Gold-plated wonder

It takes a clever man to make soap but a genius to sell it. The truth of this statement was demonstrated so vividly by William Lever half a century ago that we are surprised that the author of a recent book on detergent economics should find it necessary to re-state it. The copywriter, not the chemist, is the key man in the detergent industry. With this in mind we gave due and proper attention to the latest effusion from the Colgate-Palmolive Co. Fab, we read, is one of the company's newest products and it consists of "more than 75 ingredients made from petroleum, vegetables, coal and even flowers." Moreover it is gold-plated, or almost. It comes in a gold foil pack.

Seventy-five ingredients. That sounds like a production manager's nightmare. Well, detergents like dodecyl benzene sulphonate and lauric diethanolamide come from oil and coal. What can the other ingredients be? Take the claims one by one—A new brightening agent. In other words, an optical brightener. These are generally stilbene derivatives and current research aims at variation of the substituents on the triazine rings of the Blancophore B type. Improved soil suspension. Obviously carboxy methyl cellulose is meant here and is presumably the contribution of the vegetable portion of the raw materials.

"Most revolutionary of all—a new chemical agent which sets up an odour-resisting barrier to help keep your clothes deodorised." Here at last would appear to be a genuine advance rather than a variation of an established ingredient. Bacteria produced by perspiration can be destroyed in the fabrics by cationic or ampholytic germicides (see Manufacturing Chemist, 1957, 28 (9) 430). Such treatment lengthens the life of the textile and Colgate have no doubt been studying these possibilities for use in Fab.

It seems that a good many ingredients have been left out of this attempted catalogue of the constituents of Fab. The clue must surely be the flowers. They can only mean perfume and these, as we all know, are compounded from many and strange ingredients. We are sure that Colgate can substantiate the 75 ingredients and we are also sure that it is all not half as complicated as it sounds. But that's what happens when the copywriter takes over from the chemist.



The copyright of photographs in this article is held by N. J. Van Abbe

The photographs in this article were taken at the recently extended pharmaceutical development department of Genatosan Ltd. Right: A planetary stirrer being fixed in position on a Peerless vertical mixer. Left: Setting up a torsion viscometer; an infra-red moisture tester can be seen to the right.

Pharmaceutical Development, the Link Between Research and Production

By N. J. Van Abbe,* F.P.S., M.INST.PKG.

Pharmaceutical development is the link between research and production. It ranges from small-scale formulation of products for clinical trial to the investigation of packaging materials and the drawing up of specifications for full-scale manufacture. The scope of modern pharmaceutical development is outlined in this article.

THE compounding of chemical and biological materials into medicinal preparations has always been an art rather than a science. The pharmacist's armamentarium of excipients has some resemblance to an artist's palette and his work is similarly a combination of training, experience, skill and observation; this comparison may be extended further to include the imaginative capacity of the formulator and the importance of the subjective characteristics of his end-product. Even with the latest chemotherapeutic agents, it is still necessary to utilise the " art " of compounding to obtain suitable clinical properties with an elegance that will ensure the patient's cooperation with the prescriber. But pharmaceutics has progressed so that the successful outcome of formulation can often be judged objectively. By means of in vitro chemical and physical investigation, by in vivo biological studies and in the course of controlled therapeutic

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trials, it is possible to form an exact assessment, not only of a new drug, but of composite preparations derived from it.

A classical example of progression from subjective to objective assessment is to be seen in the literature concerning adrenaline injections; until about 1944 it was thought that colour was a reliable guide to activity, but detailed study revealed the significant factors in activity and stability and yielded the muchimproved formulation of the postwar pharmacopoeias.

Preliminary experimentation

The pharmacy section of an industrial research and development group starts work on a concept for a new product with a supply of a new drug or of an already established one along with some idea of the physiological require-

* Pharmaceutical Development Manager, Genatosan Ltd., Loughborough, Leics. ments. The ultimate success of the work depends to a great extent on the provision, initially, of the fullest possible data concerning the chemical and physical properties of the proposed active constituent(s) and similar comprehensive information on the medical aspects (biochemical criteria, pathology and so on). This background makes it possible to eliminate many unsuitable pharmaceutical techniques on theoretical grounds and helps to suggest procedures that might be employed.

The first task is to prepare some experimental formulations and examine these, in a rapid and preliminary way, for stability and other significant features. Thus, it may be known that a topical application will have to be miscible with aqueous exudates or that a tablet should disintegrate rapidly in the gastric juice; these aspects are speedily confirmed in the laboratory. The progress of development may have to be delayed in order to carry out purely



Operating a Manesty SP1 tablet press in the tableting room.

exploratory work on the pharmaceutical methods. An example from the author's experience was the need to devise a rapidly-disintegrating tablet with an active constituent liberating free iodine; a search for disintegrants compatible with iodine eventually led to the rather unexpected finding that an ion-exchange resin (Amberlite XE-88) had the desired properties.

Having devised preparations showing reasonable promise, the medical advisors are provided with specimens for clinical testing. In the preparation of placebos for double-blind trials, which are universally preferred where suitable arrangements can be made, the pharmacist's skill and ingenuity should be directed towards the preparation of inert "controls" that are quite indistinguishable from the "test" products, both to prescriber and patient; in this and other ways the pharmacist can help to ensure a realistic appraisal of a new medicament.

Preparations for large-scale manufacture

In sections of the chemical industry where output is large and continuous processes are worth while, process development is often the concern of a chemical engineering section. Manufacture of pharmaceutical products is usually on a relatively modest scale and involves unit batch production in multipurpose equipment; the pharmacist

usually assumes responsibility for development.

When clinical trials are satisfactorily completed, the development section still has a number of responsibilities:

- (a) Product stability must be fully investigated and appropriate measures taken for stabilisation or preservation.
- (b) Grades of raw materials are selected, on grounds of purity, physical properties, availability and cost; standards have to be set up.
- (c) A process for efficient and economical large-scale manufacture has to be devised and written into a manufacturing guide or specification.
- (d) Analytical standards for the finished product need to be established.
- (e) Trial production is supervised to see that full-scale results correspond to those in "pilot" production and that safety and other precautions are effective.

Pharmaceutical Development at Loughborough

The photographs in the article were taken at the Loughborough factory of Genatosan Ltd. in the pharmaceutical development department which has been extended to 4,000 sq. ft. It is fully equipped for: Experimental formulation of preparations suitable for clinical trial. Preparation of specimens for clinical trials or field tests. Investigation of product stability and development of pilot manufacturing processes as the basis for large-scale production. Investigation of packaging materials, including interaction of product and pack and shelf life. Collaboration to establish raw material quality standards and analytical specifications for intermediate and finished products. Preparation of specifications for large-scale production and supervision of large-scale trial manufacture. Investigation of production problems and user enquiries

The department is divided into a number of separate laboratories, four of which are devoted to product development, each under the control of a pharmacist. Each of these deals with a selected field and is appropriately equipped. Facilities such as a process laboratory with pilot plant for mixing, grinding, filtration, homogenising, etc., and a tableting room, are shared.

There is also a separate packaging development laboratory, an instrument room, and extensive storage test facilities.

Special attention was paid to providing facilities for shelf-life testing, since experimental evidence gathered in three to six months has to indicate the changes that may be expected to occur in two to three years' storage of a product in a wide variety of "field" conditions.

The facilities include a cold room operating at 5°C., a "temperate" room at 20°C., a warm, dry room at 37°C. 85% R.H. (constant) and a "tropical" cabinet at 37°C. 85% R.H. (constant) which is reserved for materials, the volatile constituents of which might affect adjacent specimens.

There is also a tropical cabinet operating at 37°C. 85% R.H. for 18 hr. daily, with temperature faling to ambient and R.H. rising to 100% during the remaining 6 hr., incubators maintained at temperatures of e.g. 30°C., 45°C., 55°C. according to requirements for particular samples and a "shop-window" in the open-air facing south and an ultra-violet cabinet for studies on sunlight effects during the winter months.

It is vital that detailed attention should be given to storage testing and adequate shelf space must be provided for a wide variety of simulated climatic conditions. Prediction of shelf life is necessary to establish whether a new product is fit for distribution, but certainty is never attainable; storage conditions in the field vary widely and can only be estimated approximately.

Shelf life has to be estimated on the basis of tests over a much shorter term than is likely to apply in practice, and it is seldom possible to know whether an "accelerated ageing" test has failed to detect a lag phase in decomposition extending beyond the duration of the test. For such reasons, experience of similar products and the intelligent interpretation of results are quite as valuable as the academic extrapolation of decomposition curves.

Use of pilot plant

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Development of a large-scale process usually necessitates scalingup in stages, with an intermediate pilot "-size operation. "pilot" equipment is normally selected according to the types of activity undertaken in the production unit, which may include mixing, grinding, blending, filtration, homogenising, granulating, compressing, sterilisation and so forth. New types of equipment will often be tried out on the "pilot" scale before being considered for use in routine production. "Pilot" plant should be constructed of similar materials to the large-scale equipment, so that metallic contamination, for example, may be observed at an early stage. Wherever possible there is no doubt that pharmaceutical operations should be conducted in equipment of high-grade stainless steel (e.g. Firth-Vickers F.M.B.), where metallic contact parts are involved, since many decomposition reactions are catalysed by iron and copper contami-

Pharmaceutical development in the "pilot" stage involves not only the compounding of fair-sized batches by standard methods appropriate to the various pieces of machinery available, but also the elaboration of new procedures and testing methods. Each process eventually employed in production must have been worked out speciA packaging development chemist using therefrigeration technique for propellant-charging of an aerosol can. A Druk-Pak pressure-type filler can be seen in the background.



fically in relation to the actual product concerned.

Packaging development

One of the vital functions undertaken by a pharmaceutical development section is the testing and selection of packaging materials, so that a new preparation is given a pack offering adequate protection, with minimal interaction or risk of contamination and providing a basis for the labelling and decoration necessary to complete the product.

It is necessary to acquire a sound knowledge of factors such as the moisture vapour transmission of various materials, corrosion and protective coatings, and contaminants which may be leached out of such materials as rubber and plastics. Pharmaceutical preparations differ markedly in composition and the suitability of packaging materials must be rigorously examined experimentally; storage testing under a variety of environmental conditions is essential.

The extent to which product and pack development should be separated is debatable; if widelydiffering types of products and packs are handled, there is certainly a case for employing specialists in each phase, but the two functions should not be so distinct that the interaction between them tends to be forgotten.

The future

Formulation as an aspect of pharmacy has only recently been recognised as a necessary part of the training syllabus, although it is manifestly insufficient for the pharmacist only to be fully conversant with the compounding of formulæ and prescriptions that are written out in full. The pharmacist, especially in industry, should be able to devise a formulation in which the prescribed active constituent(s) are best able to exert their optimum therapeutic action, and he must avoid untoward sideeffects due to his choice of excipients. Improved formulation technique may significantly contribute to clinical efficacy, apart from the specific action of the medicaments: at the same time, preparations should inspire confidence in the patient and help to ensure that the prescribed course of treatment is completed willingly.

Chemical Wealth from Sugar

By E. T. Dewar, PH.D.*

As a supplier of carbon the sugar industry is in a stronger position than the coal and oil industries because its raw material is perennially renewed while, of course, coal and oil deposits must eventually become exhausted. The present annual world output of 40 million tons of sugar could be doubled or trebled if sugar could be used extensively in other ways than as food. The development of sucrochemicals would create a vast new market for sugar and provide a wealth of chemical raw materials and finished products ranging from detergents to pharmaceuticals. Here is a review of progress in sucrochemistry.

WORLD production of sucrose from sugar cane and sugar beet is approximately 40 million tons per annum and this is controlled by international agreement to prevent flooding the market with surplus sugar. There is no doubt, however, that production could be doubled, or even trebled, if sucrose could be utilised in ways other than directly as a food. Chiefly by research work sponsored by the Sugar Research Foundation Inc. America and the Colonial Products Research Council in Great Britain. the industrial use of sucrose has developed to such an extent that "sucrochemicals" are now well

Since its formation in 1943 the Sugar Research Foundation has spent over half a million pounds in finding ways of making sucrose and its products more useful. The sugar industry is basically in a stronger position than the coal and petroleum industries, for sugar cane and beet provide a source of carbon which is perennially renewed, while coal and oil deposits cannot be renewed and will eventually become exhausted.

Apart from sucrose and molasses, the sugar industry provides other valuable by-products, such as bagasse, beet pulp, sugar cane wax. etc., but in this article attention will be directed mainly towards recent work on the chemistry of sucrose.

Although the structure of sucrose has been known for many years, a synthesis of this disaccharide by purely chemical means has only recently been accomplished.1

Lemieux and Huber synthesised sucrose by reacting 3:4:6-tri-Oacetyl - 1:2 - anhydro - a - D glucopyranose with 1:3:4:6-

 $(\alpha$ -D-glucopyranosyl β -D-fructofuranoside)

tetra-O-acetyl-D-fructofuranose in a sealed tube at 100° for 104 hr. Chromatographic separation of the products gave a 5.5% yield of sucrose octa-acetate.

Despite the fact that sucrose contains eight reactive hydroxyl groups, very few derivatives have been prepared and characterised due to the extreme instability of sucrose towards acid reagents. The hepta- and octa-O-methyl derivatives were obtained by Haworth and co-workers during the early constitutional studies, and recently the octamethyl ether has been prepared by a single methyl iodidesilver oxide treatment in dimethylformamide solution.2 1': 4:6'-Tri-O-methyl and 2:3:3':4:4'penta-O-methyl sucrose have also been prepared.3, 4

Allyl sucrose

This is the most important ether of sucrose from an industrial point of view. It is prepared by treating sucrose dissolved in concentrated caustic soda with allyl chloride in an autoclave at 85°C. The monomer. containing 5-6 allyl groups per sucrose molecule, can then be polymerised by heating and passing air or oxygen through it. Allyl chloride is a cheap and abundant product prepared from a by-product

* Arthur D. Little Research Institute, Inveresk, Midlothian.

of petroleum distillation. Potential applications for allyl sucrose include coatings for wood, metal or glass which are resistant to organic solvents, oils or heat; adhesives for glass or laminates; coating and impregnation of paper, textiles and other materials for improving the tensile strength and

grease-proofing properties. New products with improved properties may result from copolymerisation of allyl sucrose with various monomers. Copolymerisation with styrene gives a product having water resistance superior to that of allyl sucrose. Copolymerisation with drying oils offers a method for upgrading drying oils.

Other monomers, such as acrylates, methacrylates, maleates, maleic anhydride, crotonic acid and acrylonitrile may produce inter-

esting copolymers.

Another interesting ether of sucrose is octa-O-(hydroxypropyl) sucrose, prepared by reaction of propylene oxide with sucrose.6 It shows promise for use as an emulsifier and as a detergent and is suitable for use in food packaging materials, while fatty acid esters prepared from this ether show surface active properties. The new compound is claimed to be effective as a cross-linking agent for urethane foams and is added after the prepolymer reaction.

Octa-O-(trimethylsilyl) has recently been prepared7 by treating sucrose in pyridine-formamide solution with trimethylchloro-

It is a colourless, odourless and tasteless oil, which can be distilled in a high vacuum.

Recently, with hydrofluoric acid as a catalyst, carbohydrates and petroleum aromatics have been

nown to react to give a wide range of chemicals⁸:

$$\begin{split} & \text{2RC}_{\text{e}}\text{H}_{\text{b}} + \text{CH}_{\text{2}}\text{OH}(\text{CHOH})_{\text{4}}\text{CHO} \longrightarrow \\ & \text{CH}_{\text{2}}\text{OH}(\text{CHOH})_{\text{4}}\text{CH}(\text{C}_{\text{e}}\text{H}_{\text{4}}\text{R})_{\text{2}} + \text{H}_{\text{2}}\text{O} \\ & \text{OT} \end{split}$$

When sucrose, starch and cellulose are used in the reaction, the hydrofluoric acid first reduces them to monosaccharides. The carbohydrate and aromatic reactants are sealed in a stainless steel autoclave equipped with a thermocouple well, pressure gauge and valve lines, and the exothermic reaction is controlled with solid carbon dioxide. The following reactions have been effected: toluene with cellulose, glucose, starch and sucrose; ethylbenzene and glucose; o-xylene and glucose; dodecylbenzene with cellulose; phenol and starch; and 2: 4dimethylphenol with cellulose. It is believed that this reaction will open up new channels for the preparation of chemicals as diverse as detergents, petroleum additives, pharmaceuticals, plasticisers, resins and germicides.

Phenols, including phenol, m-cresol and resorcinol, have been shown to react with sucrose and formaldehyde with an alkaline catalyst to give resins which compare favourably with conventional phenol-aldehyde resins. Sucrose phenol-formaldehyde resins, which may be used as laminating adhesives, have the advantage that they do not build up a static electrical charge. Up to 50% of sucrose can be incorporated in these pro-

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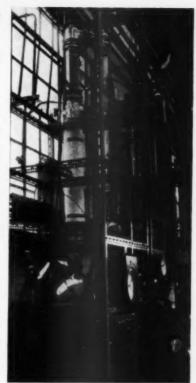
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Sucrose esters

The most important of the fully substituted sucrose esters is sucrose octa-acetate,10 and pilot plant production from sucrose, acetic anhydride and fused sodium acetate has been reported.¹¹ It is a crystalline substance which, on melting and cooling, yields a colourless, hard resin. It can be used in making laminated glass or incorporated into such synthetic resins as cellulose acetate, polymeric methyl methacrylate and polyvinyl acetate, etc. The octa-acetate has an extremely bitter taste and can be used as a substitute for bitters and as a denaturant for alcohol. Sucrose



Pilot plant used for the manufacture of sucrose esters at the laboratories of Howard's of Ilford.

octanitrate can be prepared in a highly purified and crystalline form, ¹² and by varying the method of preparation it is possible to obtain the nitrated sugar in a form suitable as an explosive for blasting operations.

Production has recently commenced of the mixed ester, sucrose acetate isobutyrate, on the 1,000 lb. weekly scale. This highly viscous product is stable and compatible with most resins, film formers and plasticisers. Main uses are in extending solvent coating formulations, increasing solids content and reducing solvent requirements and cost.

Another promising field is hotmelt coatings; paper and cloth coating uses and lacquers for plastics should also develop. Other fully substituted saturated and unsaturated esters of sucrose are known, but their properties are not sufficiently important to justify commercial production.

The most promising derivatives of sucrose from the utilisation point of view are the long-chain monoand di-fatty acid esters which possess excellent surface active properties.14 The commercial process for the manufacture of the sugar esters involves dissolving three moles of sucrose in dimethylformamide, adding one mole of the fatty acid methyl ester and 0.1 mole of an alkaline catalyst, and maintaining the mixture at about 90°C. under a vacuum corresponding to the vapour pressure of the solution at this temperature. Alcoholysis occurs and the methyl alcohol portion of the methyl ester is replaced by sucrose to form the sugar ester of the fatty acid and methanol:

 $\begin{array}{c} \text{R-COOCH}_3 + \text{C}_{12}\text{H}_{22}\text{O}_{11} {\longrightarrow} \\ \text{RCOOC}_{12}\text{H}_{21}\text{O}_{10} + \text{CH}_3\text{OH} \end{array}$

At the end of the reaction the catalyst is destroyed, dimethylformamide distilled, and the ester separated from excess surcrose. The monoester is pure enough for most purposes, although for food uses further treatment is necessary to remove traces of solvent. In this way sugar can be reacted with methyl stearate from tallow, which is a cheap and readily available material, to form sucrose monostearate which has good detergent properties. It is claimed that in a very large factory the sugar esters can be produced at an estimated cost of about 1s. per lb.15

A structural study of sucrose monolaurate showed that the product was a mixture, with the principal component having the lauroyl radical at the 6- position of the glucose portion of the molecule. 16 The sucrose esters are colourless, odourless, tasteless, edible, digestible, non-irritating detergents and emulsifying agents. Their detergent powers compare favourably with present detergents, and there is reason to believe that they will produce far less foam in sewage disposal plants than the alkylaryl sulphonates. They can be used not only as a detergent for general washing purposes but also for shampoos and in toothpastes. An instance of their use in medicine is in the treatment of faulty fat metabolism which occurs with old

Sucrose monostearate can be taken in medicinal form and acts as an emulsifying agent which helps to break up fat particles taken into the body as food. It is probable that feed efficiencies in general can be improved by adding sucrose esters

to animal feeds.

Other potential applications are in the food industry for the washing of fruit and vegetables and processing equipment, as bread softeners and as emulsifiers in margarine, as anticaking and antifoaming agents and as rehydrating agents for dehydrated foods; in the pharmaceutical industry as non-toxic, non-irritating emulsifiers of drugs to be taken orally and intravenously; in the oil industry as demulsifiers; and in the cosmetic industry.¹⁷

Glucose and fructose

Mild acid hydrolysis of sucrose gives a mixture of D-glucose and D-fructose. Glucose, prepared from maize and potato starch, is used in very large quantities in the confectionery trade, but fructose has not been readily available until recently due to the difficulty of separating it from glucose and of crystallising it. It has been estimated that it can now be made for about 2s. per lb. in very large amounts. 18 One use for fructose is as a source of sugar for persons suffering from diabetes and it is likely that many others will be discovered as the material becomes more freely available. A recent patent19 describes the separation of glucose and fructose by suspending sucrose and a cation-exchange resin in acetone containing a little water. The sucrose is hydrolysed, fructose condenses with the acetone, and the glucose crystallises out. The acetone filtrate contains 1:2-4:5-di-O-isopropylidene D-fructose, which can be extracted with benzene and the fructose recovered by hydrolysis.

Levulinic acid, which is produced by the action of acids on most carbohydrates, can be obtained in high yield from sucrose and several uses have been suggested for this material.20 Calcium levulinate is said to be more suitable than calcium gluconate for intravenous injection; phenyl mercury levulinate can be used as a detergent and in germicidal soaps. The acid has been described as a solvent for the aromatic constituents of crude mineral oil, and the combination of levulinic acid with organic amines provides derivatives of some importance. Levulinic acid can be converted into thiazole, pyridazone and pyridazine derivatives, which are of interest from a chemotherapeutic and pharmacological point of view.20

5-Hydroxymethylfurfural

On treatment with dilute oxalic acid, sucrose yields 5-hydroxymethylfurfural which is obtained chiefly from the decomposition of the fructose portion of the molecule, and this labile substance can be converted into important derivatives both by hydrogenation and oxidation.²⁰

The degradation of sucrose by alkali gives lactic acid in a yield which might well compete with the established fermentation method should the demand for lactic acid increase.

Mannitol and sorbitol

When sucrose is hydrogenated in aqueous solution over Raney nickel at 120°-130°C., inversion occurs, and the glucose and fructose are converted to mannitol and sorbitol, although other products can be obtained by varying the conditions. For example, within the last few years a process has been developed for the manufacture of glycerol which can compete with the process from petroleum by-products. Mannitol and sorbitol are readily separated by fractional crystallisation, and uses for these hexitols are now numerous.20

Fermentation processes

Many micro-organisms utilise sucrose to produce valuable chemical products. The age-old ethyl alcohol fermentation is gradually losing ground to the synthetic process based on ethylene from petroleum, but is still an important industry. The acetone-butanol fermentation utilises large quantities of sucrose in the form of molasses. Acetone and butanol are used widely as industrial solvents and in the preparation of derivatives too numerous to mention here. Citric acid is now produced almost exclusively by the fermentation of sucrose by the mould, Aspergillus niger, while the polyglucose, dextran, is produced from sugar solutions by Leuconostoc mesenteroides. Dextran is used as a blood plasma substitute, and its low molecularweight sulphate has aroused considerable interest in recent years as a blood anticoagulant. Other potentially important fermentations based on sucrose or molasses include the production of propionic acid, butyric acid, lactic acid, fumaric acid, itaconic acid, kojic acid and gluconic acid.

Various attempts have been made from time to time to get sucrose to react with carbonyl compounds, but no authentic crystalline acetal or ketal of sucrose has been reported despite the fact that it should be possible to bridge the 4: 6-positions in the glucose portion of the molecule. Sutra21 allowed sucrose to react with a large excess of paraldehyde in the presence of sulphuric acid and obtained a syrup which was claimed to be di-O-ethylidene sucrose, but it was not isolated in a pure condition. Ohle, Wolter and Wohinz²² reacted sucrose with acetone containing concentrated sulphuric acid at 0°C. to give 2:3-4: 5-di-0-isopropylidene D-fructose in crystalline form. Oxidation and removal of the acetone residues gave 2-keto-D-gluconic acid, which can therefore be prepared from sucrose in large amounts. The preparation of both α - and β -diacetone fructose

1:2-4:5-di-0isopropylidene D-fructose (a-diacetone fructose)

2:3-4:5-di-0isopropylidene D-fructose (β-diacetone fructose)

rom sucrose has been more recently studied.23

The reaction of sucrose and paraldehyde in the presence of the minimum catalytic concentration of sulphuric acid gives 4:6-mono-Oethylidene D-glucose in crystalline form in 60% yield.24

Sodium sucrates

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Recently several laboratories in Britain and America have been actively engaged in preparing sucrochemicals by coupling sodium sucrates, i.e. sodium substitution derivatives of sucrose $(C_{12}H_{22-x} O_{11}Na_x)$, with organic halogen compounds, and several new and interesting compounds have been prepared. There is no doubt that alkali metal derivatives offer enormous scope as intermediates in the preparation of ethers and esters of carbohydrates, although general application of the method is limited by the insolubility of most unsubstituted carbohydrates including sucrose in organic solvents inert to alkali metals. This difficulty was overcome by Muskat,25 who used liquid ammonia as solvent, in which all the ordinary sugars, including sucrose, and their methylated, acetylated and acetone derivatives are quite soluble. The alkali metals dissolve readily in ammonia to give characteristic deep blue solutions and the solubilities of lithium, sodium and potassium in liquid ammonia at its boiling-point (-33°) are 10.9, 24.6 and 49.0 g. per 100 g. ammonia. Muskat's liquid ammonia procedure has been extensively used for methylating carbohydrates, and in some cases it is preferred to the dimethyl sulphate-alkali procedure.

Although compounds of sucrose with metallic hydroxides, the socalled "saccharates," are well known in sugar technology, few references occur to true metallic salts of sucrose ("sucrates"). Amagasa and Onikura²⁶ found that potassium reacted rapidly with sucrose in liquid ammonia to give a dipotassium sucrate, and on addition of more potassium the reaction proceeded slowly to give a mixture of hexa- and heptapotassium sucrates. The mixture was insoluble in liquid ammonia and was pyrophoric on exposure to air.

 $C_{12}H_{22}O_{11} + 6K \longrightarrow C_{12}H_{16}O_{11}K_6 + 3H_2$

Due to its insolubility the polypotassium sucrate was not highly reactive and a temperature of 130°-140°C.

was required to effect reaction with benzyl chloride, when an oily mixture of hexa- and hepta-O-benzyl sucrose was formed.²⁷

During the past two years in this laboratory, in a project sponsored by the Sugar Reasearch Foundation Inc., the preparation and reactivity of different sodium sucrates have been examined in some detail.28 In liquid ammonia sucrose reacts with sodium at -33° C. to give stable sodium sucrates, C₁₂H_{22-x}O₁₁Na_x, with the liberation of hydrogen. Monosodium sucrate is a white crystalline compound containing exactly one molecule of ammonia, i.e. 4.47%, while the higher sucrates are white, hygroscopic powders containing considerably less ammonia (1.4-2.7%). The higher substituted sucrates, up to the heptasodium derivative, are best prepared with sodamide prepared in situ in liquid ammonia using an iron salt

as catalyst. A serious drawback in the condensation of sodium sucrates with organic halogen compounds is the general insolubility of these sucrates in solvents other than water, which immediately decomposes them with the formation of sucrose and sodium hydroxide. This means that reactions with sodium sucrate are less readily effected than in the case of highly substituted carbohydrates; e.g., Muskat25 worked with the potassium salt of di-O-isopropylidene glucofuranose which is soluble in ether and other inert liquids. Another disadvantage is the presence of firmly bound ammonia in sodium sucrate, which tends to react first with the halogen compound with the liberation of free acid, which then decomposes the sodium sucrate. For example, in the case of methyl iodide and sodium sucrate, the following reactions occur:

 $3CH_3I + NH_3 \longrightarrow (CH_3)_3N + 3HI$ $NH_3 + HI \longrightarrow (NH_4)I$ RONa + NH₄I--->ROH + NaI + NH₃

It is possible, however, by using a sucrate which is sufficiently highly substituted to swamp the effect of the ammonia, to condense sodium sucrate with cheap organic chlorine compounds to give sucrochemicals which show interesting possibilities as polymers, pesticides, surface coatings, detergents, etc. Alkali metal derivatives of sucrose show great promise as a means of preparing sucrose derivatives of industrial value.

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NEW WEEDKILLERS

Three phenylacetic acids have shown selective herbicidal activity in experiments done at Wye College, Ashford, Kent, by Pybus, Wain and Wightman (*Nature*, 1958, **182** (4642), 1094-5). They are 2:3- and 2:6-diehloro 2:3:6-trichlorophenylacetic acids. The 2:3- and 2:3:6-derivatives are said to be as effective as 2:4D in controlling many weed species.

Drying Plant and Equipment for a Variety of Tasks

The diversity of drying problems in the pharmaceutical and chemical industries is matched by the variety of machines and equipment which have been designed to satisfy these exacting requirements. Here is a review of equipment now offered, ranging from complex spray dryers and freeze dryers to comparatively simple ovens.

Spray dryers

One of the more recent developments is the Blaw Knox spray dryer. The compact horizontal arrangement of the dryer allows it to be easily installed. There are no filters or bags to replace and, because it is easy to clean and has few moving parts, maintenance costs are said to be low.

Liquid to be dried is atomised and sprayed horizontally into a heated air stream. It is stated that heat transfer and evaporation occur rapidly and that the dried material leaves the heating zone so quickly that high quality product characteristics are maintained. A dry collection system to suit the process gives high solids recovery, and the finished product is continuously discharged from one point.

Airstream dryers made by Benno Schilde Maschinenbau A.G. (U.K. agents Arpal Engineers Ltd.) are said to considerably reduce drying time. Charging and fine dispersion of the product into the hot air or gas stream is normally accomplished by the use of an agitator, while crystalline products or those which should not be dispersed, are jetted into the air stream. A feeder supplies the product continuously to the agitator or jet at a con-trolled rate. The dryer discharges into a cyclone collection system and, in the case of a very finely dispersed product, either a cloth bag collector or wet washer is used to separate the remain-The finished product is ing dust. discharged through a rotary air lock. Should it be necessary to classify the product according to size, a Schilde air-sifter can be employed.

The ring jet spray dryer of F. W. Berk and Co. Ltd. offers new designs for spray unit, air flow and powder collecting system. The spray is produced by a combination of centrifugal force and blast. The liquid to be dried is fed through the centre of a low speed, low power, silent-running spray disc, mounted in the hollow shaft of an electric motor. The disc runs inside an air nozzle so arranged that the nozzle outlet is the ring space surrounding the periphery of the disc.

The size of the droplets varies with the intensity of the blast which is governed by the air supply pressure. This affords wide control of fineness of spray, and it is claimed that the blast has the effect of blowing air bubbles out of the droplets so that spray dried powders made on the dryer have a lower air content and correspondingly high bulk density.

The spray unit is arranged for vertical downward spray, and the drying air is also introduced into the drying chamber in the same direction. The exhaust from the drying chamber is at the top. Two multiple cyclone units for the recovery of the product are mounted on opposite sides of the roof of the drying chamber.

A slowly rotating vacuum collector serves for discharging the dried powder from the bottom of the drying chamber. From here and from hoppers underneath the cyclone system all powder is taken by a pneumatic conveying or cooling system to a final discharge cyclone which may be remote from the dryer.

The Kestner Evaporator and Engineering Co. Ltd. manufactures a spray feeding device for feeding film dryers. This is known as the Roto-Dise and consists essentially of a rotating disc which carries a short feed pipe on its underside. The feed pipe dips into a reservoir of liquor, and owing to its shape induces a flow upwards on to the disc when the disc and pipe are in rotation. The liquor is



The Niro Production Minor atomiser. This is particularly suitable for short runs.

accelerated by the surface of the disc and is dispersed from its periphery as a fine spray. The centre line of the drying drum lies in the plane of the Roto-Disc and as a result a uniform spray of liquor is applied to the drum.

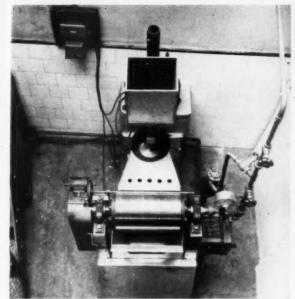
The intensity of the spray and the degree of atomisation can be varied by suitable control of the liquor level and disc speed. Advantages claimed for the Roto-Disc are uniform film production; operation of plant from nil to maximum output by regulation of spray intensity; evaporation only takes place where required, whilst liquor in the reservoir remains cold; and production of a uniform product.

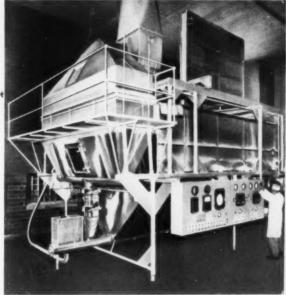
Another spray dryer, the Production Minor, is manufactured by the Niro Atomizer and Engineering Co. Ltd. This is a pilot unit and is said to be suitable not only for research work but to also have a wide application where the amount of material to be processed is comparatively small.

The air heater is designed for direct gas firing and is made in stainless steel; alternative designs for heating by means of electricity and/or steam are also available. The burners are equipped with venturi type air mixers said to be suitable for use with any fuel gas, and a venturi gas pilot and automatic flame failure safeguard are fitted. An insulated stainless steel duet leads from the air chamber to the hot air inlet which is centrally located in the top of the drying chamber.

The liquid is atomised by means of an FU-11 spinning wheel atomiser. This has a built-in air-cooled gear box and automatic forced lubrication of gears and all bearings. The atomiser wheel is designed for two-stage atomisation to ensure maximum particle formation and runs at a maximum speed of 24,000 r.p.m. The drying chamber is a cylinder with a 60° conical bottom, a height of 4 ft. and an inside diameter of 2 ft. 8 in. The inner shell is made of stainless steel and is fully insulated with a 3 in. layer of polyester plaster, covered by an enamelled mild steel outer shell finished in light grey. A fully insulated entrance door provides access to the interior surfaces for cleaning, and an illumination window and observation window permit inspection of the drying process.

The outlet air and powder are separated in an N.A. stainless steel cyclone, the flanged bottom of which is





The Kestner Roto-Disc film dryer feeder which produces a A Blaw Knox spray dyer which utilises a new horizontal high uniform film on the drying drum.

A Blaw Knox spray dyer which utilises a new horizontal high velocity design. This is said to give instant drying.

equipped with a bayonet-type lock ring for attachment of the product receiver. The cyclone is connected direct to the exhaust fan by means of swing bolts and can quickly be removed for cleaning.

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A stainless steel instrument panel is mounted directly on the drying chamber. Two indicating thermometers with remote bulbs for measuring inlet and outlet air drying temperatures are installed in the panel and an ammeter, for indication of power consumption of the atomiser, switches, observation light, atomiser motor, exhaust fan motor and feed pump, is also provided.

The evaporative capacity of the dryer depends on the inlet temperature. Table I indicates the air quantity and inlet temperature and the corresponding evaporative capacity:

Table I

Air quantity c.f.m. (68°F.)	Inlet tempera- ture °F.	Outlet tempera- ture °F.	Evapor- ative capacity lb./h.
195	356 446	176	25 36
185	527 600	212 220	45 55
170	662	220	68

Vacuum dryers

Blaw Knox vacuum rotary dryers provide low temperature drying for materials, permit agitation and include solvent recovery apparatus. The standard type consists of a stationary jacketed cylinder, heated by steam or hot water, with charge and discharge openings and an internal revolving agitator. Drying times may be

shortened by the use of a heated centre tube and agitator arms.

Material requiring uniform low temperature drying but which cannot be agitated are satisfactorily dried in the same company's vacuum shelf dryers. These are also used for the drying by sublimation of heat-sensitive products at temperatures below their freezing points.

Bennett, Sons and Shears Ltd. manufacture a continuous vacuum band dryer. The four-band machine operates at a 29½ in. vacuum which is raised by means of a rotary vacuum pump and boosted with a steam augmentor to give a 29½ in. vacuum when running. The machine is provided with four sets of steam or water heated and water cooled shelves over which the bands or conveyors run, enabling the product to be dried and cooled before discharge from the drying unit into one of the two vacuum receivers provided.

It is stated that because of the texture and make-up of the bands and their accurate tensioning and lining up, the machine is capable of running continuously for 144 hrs. The discharge can be switched from one vacuum receiver to the other, thus allowing continuous discharge of the dried product. A granulator or grinder can also be supplied on the receiver outlets prior to bagging off. The unit is fitted with variable speed arrangements for the bands and with a thermostatic control on the heating medium.

Ample light and sight glasses are fitted on the end covers and along the length of the dryer, and with access doors at each side as well at the ends,

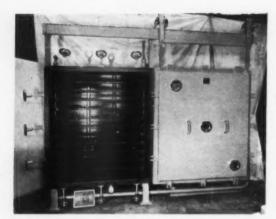
the interior is said to be easily accessible for inspection, cleaning or maintenance.

The Rotacone vacuum dryer made by Apex Construction Ltd. consists of a stainless steel inner double cone shell with attached to it a mild steel jacket. The jacketed shell is rotated on hollow trunnions in a similar manner to double cone mixers. One hollow trunnion is used for the supply to the shell of steam or hot water for heating and the other hollow trunnion is used as a vacuum connection through which the vapours are withdrawn.

The rotation of the double cone shell is claimed to result in rapid and thorough mixing of the contents, as well as high speed drying without raising the temperature of heat-sensitive materials beyond their danger point. According to the manufacturers the constant rotation of the dryer prevents caking of the product and the random arrangement of the material provides ample open space for the escape of vapour. The dryer can also be used for blending materials,

The Rotacone is suitable for heating by steam at up to 20 p.s.i. in the jacket, and the dryer is fitted with a glandless rotating seal for the admission of steam to and removal of condensate from the jacket. Where low temperature heating is required, an Apex Model 152 hot water circulation unit is said to be particularly suitable for use with the dryer.

The vapours are removed through a hollow trunnion having one vacuum tight seal only, and vacuum tightness is thus easy to maintain. All bearings



The Apex 105E vacuum tray dryer. Shelves and jackets are baffled to improve the flow of heating medium.

are external to the body so that con- at room temperature and rapidly tamination with oil or grease cannot occur.

Leybold drying equipment extends over the fields in which water vapour is removed below atmospheric pressure. For pharmaceutical work the freeze drying plants are widely used.

Recently wide interest has been shown in vacuum distillation columns for drying and outgassing essential oils, fish oils (vitamin extracts) and other materials such as monoglycerides.

An interesting recent development is a cycling process in which the removed water vapour is used to heat and dry the material under process. Precise control can be kept on the temperature of the processed material, the upper limit being directly related to the steam pressure in the equipment, and this can readily be controlled by valve gear, thus eliminating damage through over-heating. A further advantage is that by using only the water vapour that has been liberated from the samples contaminants are excluded.

The Leybold plant for this work is based on the Roots pump, which can now be supplied with fine enough clearances to give an ultimate vacuum of 10-5 mm. Hg or better. With such a pump a plant can be constructed which can quickly be pumped down from atmospheric pressure to normal drying pressure. Then by changing the position of the pump in the pumping circuit using valve gear, it can be used as a re-cycling medium for the super-heated vapour. This vapour is passed over the material to be dried and liberates further quantities of water vapour which is then passed through a condenser where a proportion is condensed out, the remainder being re-cycled back through the Roots pump and through a super-heater. According to the manufacturers such processes can only be carried out with rotary piston pumps of the Roots type which have been constructed to allow

for the heat transfers and expansions that will occur within the pump.

Freeze drying

Freeze drying, specialised form vacuum drying, is now being used on a wider scale by the pharmaceutical industry. Edwards High Vacuum Ltd. manufacture complete plant for this type of work. In the freeze drying process aqueous suspensions and solutions are frozen and the ice is then sublimed, leaving a dry spongy product which can be stored for long periods

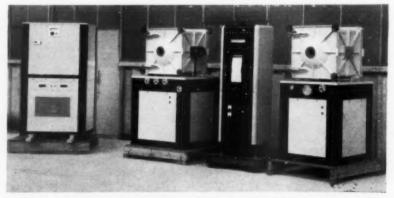
reconstituted in cold sterile water.

Freeze drying is used on a large scale for thermo-labile substances. However, with freeze drying it is easy to preserve sterile conditions and this, together with the accuracy and convenience possible when dispensing liquids into small vials for subsequent drying, has proved a great attraction to the pharmaceutical chemist. The technique is therefore being applied to other materials which are already produced in a dry crystalline state.

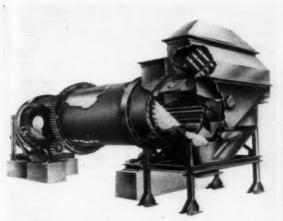
One of the most versatile of the Edwards range of freeze drying plants is the series 51P. This has five shelves each approximately 17 in. square, housed in a cubical vacuum chamber constructed of aluminium alloy. These shelves can be refrigerated to -35°C. or heated by thermostatically controlled electric heaters to 60°C. The pumping system comprises two single stage Speedivac gas ballasted rotary vacuum pumps mounted together to form a two-stage combination. Water vapour from the chamber is trapped by a refrigerated condenser operating -50°C. During drying the chamber vacuum will vary from approximately 200 microns at the start to 50 microns at the end of the cycle.

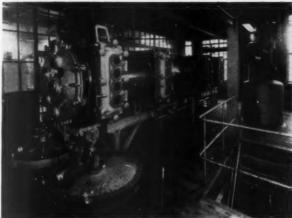
The drying trays can accommodate up to 10 litres of bulk fluid and a slightly less quantity if vials are used. The total cycle of freezing and drying to a final moisture content of 1% or less is dependent on the depth of material in each tray and the temperature used. For an antibiotic contained in the trays at a depth of 11 mm., a complete cycle would take less than 24 hr. Eight litres of a particularly difficult vitamin B¹² complex, contained in 2,000 vials and drying below -25°C., would take approximately 48 During drying an automatic record is made of vacuum and temperature readings by the vacuum and temperature measuring equipment housed in a separate control cabinet. Automatic devices also prevent spoilage of the product should partial loss of vacuum occur. Further drying to a residual content below 0.5% is carried out in an auxiliary vacuum system provided with desiccant trays containing P₂O₅. In this system arrangements can be made for automatic stoppering of the containers.

A larger version of the 51P is now being constructed by the company for production drying of streptomycin for the Czechoslovakian government. This plant will consist of three units each capable of handling 100 litres of streptomycin every 24 hr. The antibiotic is placed into stainless steel travs while in position on the shelves of the freeze drier. The trays are provided with a specially designed stainless steel cover permitting a flow of vapour during drying but capable of protecting the product from contamination caused by deposition of foreign matter from the atmosphere. The shelf assembly is housed in a 5 foot diameter bell-shaped vacuum chamber suspended from a hoist, and the panels and controls are sealed so that the sterile loading and operating area can be maintained at a pressure slightly above atmospheric.



A complete 51P freeze drying plant showing, from left to right: refrigeration, primary, recording and secondary cabinets.





Left: Dunford and Elliott rotary louvre dryer. Only a small part of the heating or cooling medium passes through the moving bed of material, whilst the major proportion passes through the louvred channels. Right: A band drying machine by Bennett, Sons and Shears Ltd., showing the two receivers at the discharge end. The distillate tank and thermo compressor are on the left-hand side.

These 100 litre plants are pumped by the new large capacity *Speedivac* rotary pumps, a 1SC3000 single stage model which is backed by a 1SC150, thus forming a two-stage combination.

The residual moisture content of freeze dried and other substances can be determined by the MDA2 micro moisture determination apparatus, which is said to be sensitive to 1 microgram of moisture.

Rotary dryers

Rotary dryers made by Manlove Alliott and Co. Ltd. are at present available in sizes 2 ft. 3 in. in diameter and 3 ft. in diameter, increasing by multiples of 6 in. up to and including 8 ft. diameter and in lengths to suit customers' demands, or to meet the requirements of any particular drying problem.

The machines are driven by a spur pinion engaged with a spur ring attached to one of the path rings and are carried on double swing undergear having eight cast iron path rollers. Ample adjustment is provided for taking up wear on the rollers, and "creep" is prevented by two thrust rollers acting on the trailing end path ring. The dryers are fitted with interior lifter flights to allow the material to be lifted and dropped through the hot air stream. Shells and hoods can be supplied in mild steel, Monel metal and stainless or stainless clad steels, and heating is normally provided by steam heated air.

A wide variety of materials may be processed by Blaw Knox drum dryers which are made in several models, including single drum, double drum and twin drum machines. These units are horizontal rotating cylinders heated internally by steam or other heat transfer medium. A film of material to be dried is formed on the rotating drum and is removed by a knife

when dry. The dryers may be operated under atmospheric conditions or enclosed to permit vacuum drying or the drying of toxic or flammable materials.

Dunford and Elliott Engineering Ltd. report interesting developments with regard to dryers and similar equipment based on the rotary louvre principle. This embodies the non-cascading movement of the material being treated, with consequent reduction of degradation and wear on the internals of the louvred drum, together with the technique of heat transfer by convection through a moving bed and, in some cases, a partly fluidised bed of material. recent development is the adaptation of this principle to a semi-direct sytem of drying or cooling.

With this system it is stated that only a small proportion of the heating or cooling medium passes through the louvred channels which are discon-nected from the actual bed of the material, resulting in a combination of low velocity through the material with a high degree of heat exchange by conduction from the metal to the material. According to the manufacturers the system has advantages when handling fine and dusty materials, as it cuts down the entrainment dust losses normally associated with a direct heated dryer, and yet maintains the high thermal efficiency of the latter compared with that normally obtained with an indirect type of unit.

The semi-indirect unit can also be operated without the above-mentioned small flow of heat exchange medium through the moving bed of material, solely by conduction from the internal high area ratio of metal to material of the internals.

Another development is the method of moisture control through the rotary louvre dryer. Dunford and Elliott claim that in the design of the dryer a

direct relationship can be established between either the moisture content of the material entering the dryer and its rate of feed or, alternatively, one or the other of these two variables and the temperature of the heating medium leaving the moving bed inside the dryer at a certain predetermined point according to the type of material being dried. By this method any changes in moisture content or feed rate are anticipated before the material is discharged from the dryer.

In practice, this means that variations of initial moisture content and feed rate are controlled by automatically varying the heat input, and by so doing a constant moisture content of the discharged material is obtained within reasonable limits.

Film dryers

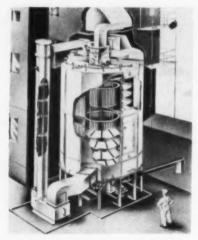
Both single and double roll types of film dryers are available from Manlove Alliott and Co. Ltd. These have rollers in east iron, stainless steel clad or chromium plated iron, and phosphor bronze, and range in size from 12 in. diameter by 18 in. long to 48 in. diameter by 104 in. long.

The rollers are carried on substantial

The rollers are carried on substantial end frames, and the knife bar has two adjusting screws and independent setting screws spaced along the edge of the knife. The machines are normally fitted with a variable speed device having a speed range suitable for the product being dried; an oscillating doctor knife and forced lubrication can also be fitted.

Pneumatic ring dryer

The ring dryer is claimed to be the only pneumatic dryer affording full control of drying time, drying temperature and material flow. Material to be dried travels round an endless ring duct continuously for several minutes, whilst the drying air is constantly



The Sturtevant-Wyssmont closed circuit Turbo-Dryer.

renewed. The manufacturers, F. W. Berk and Co. Ltd., state that the material to be dried can be held in prolonged airborne circulation under conditions that can be freely selected within a wide range.

A fan is the only moving part of the drying system and is said to produce a vigorous circular flow and continuous renewal of the drying medium in the ring duct. The inlet and outlet of the duct are combined in a manifold. whilst fresh hot air enters through an injector. Spent air is withdrawn through the centre of the manifold. The material to be dried is cascaded into the ring duct by a feeder, when it becomes airborne and is carried round the duct in floating contact with the stream of hot air. Owing to the rotary movement in the manifold the main stream of material travels along the outer wall and continues to circulate in the ring duct, entrained and boosted on by the jet of drying medium entering through the injector.

The fresh drying medium is drawn into the plant through a filter and heater. The method of heating can be selected in accordance with the requirements of the product, and can be by steam, electricity or fire heated air. Waste flue gas can be utilised either direct or through heat exchangers, while products of combustion from gas, oil or coke can also be used. High thermal efficiency and control of moisture content in the exhaust gas can be achieved by partial recirculation of exhaust gas.

The finished product leaves the manifold with the spent drying medium and is finally discharged through a separator the design of which is adapted to the properties of the product. A variety of centrifugal separators, textile filters and electrostatic precipitators is available for this purpose. The dryer can also be fitted with a disintegrator to control particle size.

"Turbo" tray dryer

The Sturtevant-Wyssmont Turbo-Dryer can handle granules, beads, powders, crystals, pastes, sludges and slurries. It is used for continuous drying, cooling or subliming; for drying without overheating in open or closed circuit; and for solvent recovery in closed circuit with inert atmospheres. Temperatures are easily maintained and controlled up to 600°F.

Some of the advantages claimed are:

- 1. No overheating—superior temperature control.
- 2. High drying uniformity.
- 3. Practically no production of dust.
- 4. No caking of the product.
 5. Dust-free and fume-free surround-
- ings.
- 6. Continuous uninterrupted operation.
- 7. Low operating cost.
- 8. Low maintenance cost.

The Turbo-Dryer consists of a stack of annularly disposed travs, in the centre of which Turbo-Fans revolve to circulate the air over the travs. The product on each tray is wiped off after the tray completes a revolution, falling on the tray below into a pile which is levelled. The repeated piling and gentle spreading of the product on the trays is said to prevent caking and to ensure maximum uniformity in drying, while the absence of continuous agitation prevents disintegration and formation of fines. From the lowest tray the product falls to the bottom of the dryer, whence it is swept into the discharge spout. Internal air circulation gives uniform temperature in each zone, so that there is no overheating and the temperature of the material is kept under control.

The company also supplies a closed circuit system with solvent recovery. Advantages claimed for this system are improved quality of product, because the low boiling-point solvent permits lower drying temperatures; improved washing through the use of a more suitable solvent; increased

filter or centrifuge capacity; and reduced drying heat requirements because of low latent heat; it is further claimed that use of the dryer enables low temperature vacuum batch drying to be changed to continuous atmospheric operation.

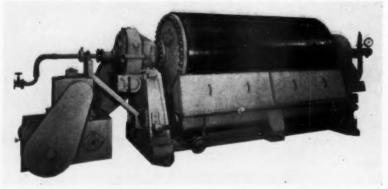
These advantages are obtained by the closed circuit system in which the heat transfer medium, usually an inert gas to eliminate explosion hazards, is continually re-circulated with practically no loss to atmosphere.

The closed circuit system has also been applied to the continuous purification of solids by entrainer sublimation, with air or any inert gas as entrainer. The Turbo-Dryer sublimer closed circuit system consists of a feed hopper, Turbo-Sublimer, entrainer filter, recirculating fan, condensers and reheater. Pre-heated entrainer gas is re-circulated over the product and then, with a high concentration of product vapour, is cleaned by passing through a filter. It enters the condenser system where the purified product is deposited and the gas returns to the sublimer via the re-heater.

Small unit Turbo-Dryers are supplied completely assembled and insulated and ready for operation after connection to heat and power. They are suitable for pilot plants or small production and can also be used as batch dryers.

Inert gas dryers

Another type of dryer employing dried and possibly inert gas is made by the Incandescent Heat Co. Ltd. The dewpoint of this gas is maintained at a very low value so that the vapour pressure of the water contained in the substance is sufficient to cause rapid evaporation. The presence of air or an inert gas reduces the tendency of the drying material itself to evaporate, as it would do if dried under vacuum. The Incandescent Heat Co. Ltd. manufactures two main types of equipment for these operations: adsorbent dryers and inert gas generators.



A 48 in. by 104 in. single roll film dryer manufactured by Manlove Alliott and Co. Ltd.

The machine has an oscillating doctor knife and forced lubrication.

The Hydromaster adsorbent dryer repends for its operation on silica gel, humina, or molecular sieves. Dryers re available for drying most gases to dewpoints below $-40^{\circ}\mathrm{F}$. In special cases, by the use of molecular sieves, this dewpoint may be reduced to below $-100^{\circ}\mathrm{F}$. (approx. 200 p.p.m.). The dryers consist of two chambers each filled with desiceant material, one of which is regenerating while the other is operating. Plant operation, including changeover, is claimed to be completely automatic.

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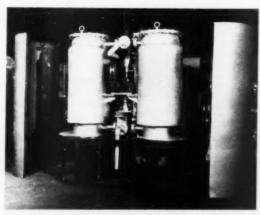
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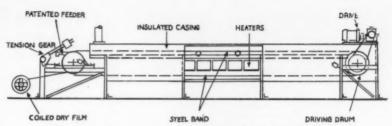
Inert gas generators use town gas, liquefied petroleum gases or even waste solvents and vapours to remove by combustion the oxygen present in air. leaving the inert gases nitrogen and carbon dioxide saturated with water This mixture may be separated into its components where necessary. Where it is essential that no oxygen is present, as in drying some quinones and other organic compounds, the inert gas generator may be used to feed a stream of gas to the dryer before passing it over the material to be dried. It is stated that oxygen may be reduced to less than 10 p.p.m. by this method.

Conveyor dryers

Steel band conveyors use a solid flexible steel band as the conveying medium and are said to be particularly suitable for carrying materials through drying ovens and tunnels. A recent installation made by Sandvic Steel Band Conveyors Ltd. is for drying latex rubber solution of 60% concentration with the material not exceeding a temperature of 50°C. The liquid material is spread in an even layer on to the band by means of a special feeder which is adjustable to suit the concentration of liquid and the thickness of film required. The band then passes through an insulated casing where heat is applied to the underside of the band by an electric element, thus evaporating the moisture and



A front view of the Hydromaster dryer with the covers removed.



Layout of steel band conveyor for drying latex rubber solution.

leaving the rubber film on the band. which passes round the conveyor and is wound off on to a spool.

The manufacturers stated that during drying it was found that 24,000 B.T.U.'s were absorbed per hr. and a machine having 35 ft.-0 in. centres. with a belt width of 32 in. is capable of producing about 100 lb. of dry film per hour at a speed of 22 f.p.m. and a thickness of 0.006 in.-0.007 in.

It is normal practice to insulate the tunnel casing and the band can be carried on rollers, transverse cast iron skids or longitudinal slides. The band is said to be held at a constant tension regardless of heating by means of spring loaded automatic tension gear.

The steel band is produced in carbon and stainless steel qualities and can be supplied in widths from 4 in. to 32 in. The carbon steel band is suitable for temperatures up to 350°C. and the stainless band up to 500°C. and they have been used in conjunction with hot air, infra-red, radiant heat, gas and electric heating for the drying of such materials as catalyst mud, various chemicals in the form of powders and pastes.

Electric ovens

The General Electric Co. Ltd. manufactures a wide range of industrial electric ovens suitable for a variety of processes. Standard ovens are made in a number of different sizes and can also be designed to meet particular requirements and to include special features.

Loss of heat by conduction through the oven walls is kept to a minimum by double-cased construction, the enclosed space being packed with a refractory. The thickness of the insulation depends upon the working temperature of the oven and is normally between 1½ in, and 4 in.

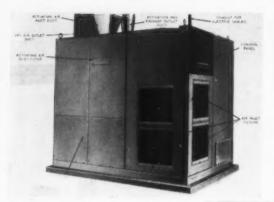
Either tubular or sheathed wire industrial heating elements are fitted; both employ nickel chrome resistance material and are mounted in the oven walls behind baffles. All ovens are fitted with full length swing doors of double-cased, heat-insulated construction. Fans for forced convection can be fitted and may be of the extended shaft or standard high temperature centrifugal types. In both cases internal air-circulating ducts are included.

The ovens can be arranged to take work on trays or on bogies. When trays are used, the oven side baffles carry light angle iron runners. Ovens for bogie-charging are supplied with extra floor supports and guide rails to ensure that the weight of the charge is carried on them.

Electric ovens are also manufactured by A.E.W. Ltd. They are of double case construction with 3 in. thick thermal insulation between the inner and outer case, held in a welded steel frame and fitted with insulated doors. The shelves may be arranged to suit customers' requirements. Heating is by replaceable metal sheathed 80/20 nickel chrome elements evenly distributed over the back of the oven in a separate compartment. Terminations are by nickel leads outside the oven to bus bars supported on porcelain insulators. All elements are connected in parallel so that the failure of one does not affect the remainder. The standard ovens are rated to reach maximum temperature in 1 hr. from cold without air exchange or charge, but this can be varied according to requirements.

Temperature is automatically controlled by an indicating thermometer regulator, and the bulb is placed in close proximity to the elements to obtain maximum sensitivity. An energy regulator is incorporated to obtain close differential over the full temperature range. If required, a safety thermostat may be fitted in the same circuit to limit the temperature rise of the oven should the thermometer regulator fail to act.

An impeller fan driven by a synchronous electric motor is fitted in the top of the oven chamber and both exhausts and recirculates the air. The fan motor and heater control circuits are interlocked so that the heating elements cannot be switched on without the fan, and in the event of-the motor failing the heaters will be switched off. A control panel is provided at the side of the oven incorporating thermometer regulator, relay, energy regulator, contactor, motor switch, indicator light and fuses.



Right: The Service Electric Co.'s Model 74 blower with heater unit and air filter. It incorporates both air flow and temperature regulation.

Left: Silica Gel dehumidifying plant.

Below: Pfaudler glassed-steel conical dryer-blender.

Blender-dryer

The Pfaudler conical glassed-steel blender-dryer is designed for drying and blending a number of powdered and corrosive materials to produce a homogeneous product with, it is claimed, considerable savings in operating time and costs. The glassed lining of the dryer resists product adherence, thus reducing clean-up losses and labour and improving heat transfer; it also prevents metallic contamination. It is claimed that the acid and alkali resisting glass lining can be used for every acid except hydrofluoric and for alkalies up to pH 12 at 212°F.

In operation the product is fed into the vessel through a manhole which is then closed. Rotation of the vessel is begun and the bottom cone tilts to a point where the angle of repose of the contents is exceeded. The top layers of the material then roll down towards the opposite cone followed by the whole mass, while the conical walls deflect it towards the centre.

If desired, air can circulate into the vessel through the bleed valve in the cover and out through the vacuum line, carrying vapour with it. The jacket around the outside of the vessel is usually heated with steam or hot water.

The heating medium circulates through the centre of the trunnion and out through pipes leading from the top and bottom of the jacket by means of a rotary joint. The inner tank will withstand full vacuum or up to 20 lb. p.s.i., the standard vacuum pipe is Hastelloy "B", but other materials may be used as required by the product.

The jacket is of mild steel and will accommodate pressures up to 40 lb. p.s.i. with full vacuum in the inner tank. Neoprene gaskets are fitted as standard, but Fluon envelope type may be fitted if specified.

Rotation is by electric motor and gear drive, while a variable speed drive is also available for all sizes as an extra. The magnetic disc type brake can be mounted either on the motor or on the floor.



Silica gel dryer

A drying plant recently installed by Silica Gel Ltd. is claimed to maintain a relative humidity of 30-35% irrespective of external conditions, in a preparation, storage and packing room, handling a hygroscopic granulated medicinal product.

During working hours, up to 15 operators are present in the conditioned space and the dryer supplies sufficient fresh air to maintain comfortable working conditions for the personnel. At night, this fresh air is automatically shut off and the extra capacity available from the plant is used to pull down the moisture content of the products due to be packed on the following day.

The unit utilises the moisture adsorbent properties of silica gel to remove the excessive water vapour from the area. The adsorbed water is then driven off from the silica gel by the application of heat. Two adsorbers are fitted, each containing a bed of silica gel; one adsorber is used to remove moisture from the air passing through the unit, whilst the other is being reactivated by a stream of hot air.

A by-pass system is incorporated in the plant so that when the relative humidity is reduced to the required



level the air is no longer passed through either of the gel beds, but is merely circulated throughout the conditioned space. Not until the humidity once more begins to rise does the unit act as a dryer, and should the partially saturated bed in operation be unable to cope with the rise in humidity an automatic changeover to the fully activated bed takes place.

The wet air is drawn into the unit through brush type filters and is propelled through the gel bed by a multi-vane fan. The conditioned air is then equally distributed throughout the room by means of overhead ducts which extend along the length of the building. The air for drying the gel bed undergoing activation is drawn from outside the building and is propelled by a fan over an electric heater before passing through the gel bed to pick up the released moisture and discharge it external to the conditioned space. The unit is fully automatic in operation, its main control being an electrically connected hygrometer placed in the room.

When working under maximum humidity conditions the unit consumes approximately 24 kW of electricity and has a maximum water removal rate of approximately 22½ lb./hr.

Hot air equipment

"Secomak hot" air equipment, made by Service Electric Co. Ltd., consists essentially of small tubular type heaters of special design which are capable of high loadings and through which air is forced by means of high velocity centrifugal fan units. The heated air may be applied directly through a single nozzle or it may be piped away to the point of application. Alternatively, it may be supplied at a number of different points through a manifold. A number of heater units may be used at strategic points and supplied with air through pipes from a single blower unit.

Cosmetic Science at German Congress

The International Congress of the Society of German Cosmetic Chemists took place in Bonn in September. The German society, barely a year old, already has over 100 members. It looks upon itself as a purely scientific society, and the papers presented at the Congress bore out this leaning towards the academic. Here is a specially contributed review.

MANY papers were concerned with the physiology of the skin and hair and with the reactions of products applied to them.

Essential oils and perfumes

The pharmacology of the volatile oils1 was discussed and the responsibility for irritation laid at the door of terpenes and aldehydes contained in such oils. bactericidal power was commented on, as were their varying routes of excretion through the lungs, the kidneys, the skin and even in some cases through the mammary glands. Oils containing azulenes were described as having antiinflammatory powers. Another paper² was concerned with the chemistry of the azulenes and their various pharmacological effects. Perfumery materials were tested for their power to irritate the skin in the form of w/o emulsions containing 1.2% of various ingredients.3 Most tests were concerned with primary irritation, though sensitising power was looked for in a few of the substances under test.

Another paper was concerned with the effect of vehicles on scents.4 These interactions have hitherto been built into a body of experience which a competent perfumer had to acquire. A comparison of the odour intensity of a variety of substances in water and in oil was carried out in a series of experiments designed to yield statistically valid results. The author of this work appeals for widespread co-operation so that similar experiments may contribute to a scientifically precise basis for perfumery. The market research often carried out in order to decide on the probable popular appeal of a scented cosmetic product was heavily under fire.5 In the absence as yet of precise knowledge as to how people are affected by perfumes it was strongly recommended to accept the views of perfumers and marketing experts as to the desirability of some particular scent.

Mathematics were the subject

of a paper6 in which the author pointed out that many aspects of cosmetic science were susceptible to mathematical discipline. The examples which were quoted fell into the statistical field covering such questions as the significance in the difference between analytical results obtained on two samples purporting to represent the same raw material. The importance of correctly designed organoleptic tests was also stressed.

Effect of fats and oils on the skin

The spreading of 20 different fats and oils on skin was examined7 and it was found that such substances do not, or at best hardly, penetrate the skin. The apparent "disappearance" of fatty materials when they are rubbed "into" the skin was an illusion due to spreading into a very thin film. The fine structure of the skin played an important part and, being different from person to person, and even from one part to another on the same person, made it impossible to predict the spreading powers of any fats with certainty. Similar views were presented in another paper8 which states that it could be concluded with certainty that "feeding" the skin by cosmetics was not possible. Interference with the biochemical processes of the skin went beyond the limits of the cosmetic art which should be restricted to external improvements of appearance (make-up) or protective measures.

The use of organic derivatives of phosphoric acid was discussed in a contribution9 which pointed out that such substances frequently occurred as natural surface-active agents. The sulphates, which were more active by far, interfered with the body proteins by salt formation and were useless for the normal functions of the tissues. The natural phosphatides had surprisingly good powers of emulsification and dispersion, but tended to be unstable. Synthetic phosphates, especially those containing esterified fatty

acid groups, were stable, harmless to the skin and very useful in making a range of cosmetics. They also had considerable powers as vehicles for a variety of active ingredients.

Protein hydrolysates and their derivatives were described as suitable materials for improving the texture of the skin.10 The best action was ascribed to fat-soluble esters of amino-acids, especially the cholesteryl esters. In decreasing order of efficiency suitable mixtures of amino-acids were derived from connective tissue, plasma, blood, skin and keratin. These derivatives were also being tested for their effect on hair and promising treatments had been carried out.

Shampoos

Another paper¹¹ discussed the possibility of extracting nitrogenous substances from hair by means of water and alcohol. Reference was made to the fact that hair which has been washed with detergents, or had been extracted, became hydrophobic. From this it was deduced that the wettability of hair depended on its content of alcohol-soluble and water-soluble materials rather than on that of fatty substances. The extracts contained peptides whose nature depended on the temperature of extraction. The higher this temperature the more did the peptides resemble hair in their composition, and the greater was the yield.

Extracts of various organs were examined12 for their content of inorganic ions and enzymes. Both aqueous and glycerol-glycol extracts of human placenta, rumin-ant's embryos and ruminant's connective tissue, were used in this work, the cosmetic significance of which is not entirely clear to the reviewer.

Hardness of creams

Physico-chemical measurements were the subject of a number of contributions. One worker compared the results obtained with

different pentrometers.13 When measuring the hardness of creams a 30° cone gave the best characteristics using vessels of 10 cm. depth and 10 cm. diameter to contain the cream. Variations in room temperature had little effect on the reproducibility of the results, but a temperature increase of 30°C. caused appreciable softening. Redifferent sults obtained with penetrometers were not the same

but were comparable. The hardening of shaving creams at high temperatures was investigated¹⁴ by studying pure potash soaps of myristic, palmitic and stearic acids. It was found that the cause lay in a disturbance of the gel formation during the cooling of a concentrated hot soap-solution by the appearance of crystals of acid salts of the fatty acids. The temperature at which precipitation occurred rose with the number of C-atoms in the fatty acid molecule. Further cooling (about 10°C. lower) could lead to a partial or complete disappearance of the crystalline precipitate, presumably because of reduced hydrolysis, and renewed gel formation. The concentration of the soap solution played a decisive part in these hydrolytic and colloidal processes.

Colour measurement

Measurement of the colour of cosmetic products is usually fairly simply done by photoelectric means. More difficulty was encountered when trying to determine the colour given by a cosmetic product on some substrate. Oxidation dyes are a case in point and the author of this paper 15 treated transparent plastic foil with the dyes under test and then measured their colour by means of a spectrophotometer. Complete absorption curves could be determined, but usually it was sufficient to measure the absorption at a few wavelengths characteristic of the colour under test. Accuracy lay at ±0.3% transmission or absorption.

Hair dyes

The effect of oxidation dyes on hair was studied by slow-motion films and other photomicrographic techniques.16 It was found that the morphological condition of the fibre was less important in hairdyeing than other changes which affected the hair in the course of ordinary wear and tear. Slowmotion films of hairs being dyed

showed the succession and interaction of swelling, solvent diffusion, dve component diffusion, oxidative pigment formation and rinsing. The different behaviour of normally worn, cosmetically treated, mechanically damaged and U.V.irradiated hair towards hair dyes was demonstrated.

Two contributions discussed the cross-links of hair-keratin and some of their reactions. The sodium salts of organic thiosulphates (Bunte salts) react with mercaptans in the ionised state to give disulphides and sulphides. By utilising this reaction in connection with the cysteine contained in reduced hair17 it was possible to introduce extra sulphur into the hair by using bifunctional Bunte salts.

$$-O_3SS$$
— $(CH_2)_n$ — $SSO_3^- + 2Keratin$ — S^-
 $----$ Keratin— S — S — $(CH_2)_n$ — S — S —
Keratin $+2SO_3^-$

The sulphur thus added to the hair was shown by hydrolysis, paper chromatography and reduction with HI to be in the form of disulphide links. The reaction could be useful in the permanent waving of hair.

The reaction of mercaptans with disulphides was shown to be dependent on pH because it was a nucleophilic interaction between mercaptide ions and disulphides.18 The reaction proceeded in stages and asymmetric disulphides occurred in finite concentrations as part of the equilibrium. Experiments designed to produce pure asymmetric disulphides led to the conclusion that such substances as well as mixtures of disulphides were labile. Any mercaptide ions which might be present caused an exchange of anions in the form of chain-reactions which could only be terminated by substances which reacted readily with mercaptans. Mercaptide ions could be produced by hydrolysis or even by photolysis. These reactions were of great biological importance but also had consequences which were significant in a hair-cosmetic context.

Glass containers

Cosmetics are frequently stored or packed in glass containers which are not as inert as one tends to believe.19 Tests designed to estimate the alkalinity of different glasses were critically examined and a method superior to the official one of the Deutsches Arzneibuch (DAB) was proposed. It was pointed out

that in testing the resistance of a product to glass it was insufficient to examine the effect of 0.1 mg. of alkali throughout the contents of a container, because the local alkalinity near the glass wall could be very much higher and could start a series of reactions leading to decomposition of contents.

Emulsifiers and preservatives

The eighth paper in de Navarre's series on the Interference of Nonionic Emulsifiers with Preservatives was presented at the Congress.20 The effect of propylene glycol; 1: 3-propanediol; 1: 4 buane-diol; sarbitol, glycerol and hexylene glycol on preventing the inactivation of methyl p-hydroxybenzoate by G-3720 was discussed. organisms used were Aspergillus niger and four bacteria.

Antiperspirants

Some new work on sweat secretion was presented.21 The Ping-Pong ball test for the axilla, the Prussian Blue test and the Bromophenolblue test for palms and soles were used to determine the effect of antiperspirant drugs, the protective action of skin fat and the influence of age and sex on the secretion of sweat in the three regions under consideration.

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- On a Nitrogenous Hydroxy-com-pound in Human Hair," by H. Freytag.

(Continued on page 472)



Orders for some of the 1,300 branches of Boots are seen here being assembled as unit loads in the Toilet Department of Boots' new £700,000 warehouse in Island Street, Nottingham. On the left, branch orders are seen being selected by order girls from the stock bins into special nestable trays. The trays are then passed to the packer, who secures the lids with wire and then stacks the trays on a stillage behind him until the complete order has been assembled. The stillages, on special hydraulically-operated lifting trucks, are then attached to a 500 ft. overhead dragline conveyor which moves them to the lifts, carrying the branch order as a complete unit load.

Speedy Handling at Boots' New Warehouse

A NEW warehouse at their Island Street premises in Nottingham has been brought into operation by Boots Pure Drug Co. Ltd., in good time to cope with the vastly increased volume of dispatches for the Christmas trade now in full swing at every one of the firm's 1,313 shops. Providing 150,000 sq. ft. of floor space on five floors and a penthouse, the new building is linked at every floor with an older warehouse. At Nottingham Boots now have 500,000 sq. ft. of warehouse space, and at nearby Beeston another 350,000 sq. ft. Warehouses in London, Airdrie and Heywood contribute another 400,000 sq. ft. to make up a grand total of 1.25 million sq. ft. of warehouse space.

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Annual output of goods from the new warehouse totals 25,000 tons a year. The problem of speedy dispatch has been tackled by concentrating on the assembly and movement of goods in unit loads at the earliest possible stage. £50,000 of the £700,000 spent on

the new warehouse has gone on dragline conveyors for each floor. Each of these 500 ft. long overhead conveyors moves hydraulically-operated lifting trucks on which are transported the stillages carrying the unit loads.

As far as possible, orders for individual branches are kept on separate stillages and all movements of goods within the warehouse commencing in the Receiving Department are made on these platforms. There are between 15,000 and 20,000 stillages in use in the Island Street warehouse and goods are kept on stillages up to the last possible moment for ease of handling.

Between 75 and 80% of the goods from the new warehouse are sent to Boots' main dispatch docks at the Beeston factory, where they are combined with goods from other warehouses and departments for the same branches.

The goods are carried to Beeston on stillages as unit loads, and

although there is a loss of trailer space, this is far outweighed by the speed of loading and unloading. Even with loading of railway trailers, it is possible to use the same system and take stillage loads of goods right to the dock edge. The mechanical handling equipment and methods introduced in the new warehouse have meant greater efficiency. In addition to the order assembly and dispatch function there have been increases in efficiency in the handling of incoming goods which have resulted from the introduction of unit loads on standard stillages which can be moved direct from transport vehicles by hydraulically-operated lifting trucks. Unloading times have been cut from as much as 3 hr. to less than ½ hr. Boots are encouraging manufacturers wherever possible to adopt the principle of stillage or pallet-loading which will aid efficiency and reduce costs to both supplier and receiver.

At the east end of the new build-

ing are four lifts, each with a capacity of 3 tons and a speed of 150 ft. per min., which carry six standard (2 ft. 6 in. by 3 ft. 6 in.) stillages and a lifting truck, as well as the lift operator. They discharge directly on to the dispatch dock, which can accommodate 18 vehicles.

The building is a development of the best ideas found in similar warehouses in this country and abroad, which were studied before Boots began construction of the

warehouse in 1955.

One of the most important developments in Boots' warehousing methods in recent years has been the introduction of nestable trays for the assembly and dispatch of goods to branches. These containers, designed by the warehouse staff, are made of plywood, with sloping sides and a detachable lid. When empty they can be "nested" one inside the other, with the lids

tied separately. After many experiments a size of 24 in. by 18 in. and 10 in. deep was found to be the most suitable. There are between 160,000 and 175,000 of the nestable trays in use. They were introduced about three years ago and cost about 13s. each. Most of the original batch of trays are still in use and it is estimated that less than 5% have been lost or damaged. Originally the estimated life was a maximum of 60/70 journeys, but this is likely to be exceeded.

It takes three to four trays to accommodate the goods which previously were sent out in a standard heavy wooden case. When the trays are empty, 12 trays take up the same space formerly occupied by only one packing case.

One of the main reasons for introducing the trays is to make consignments suitable for handling by shop staffs, since it is now

difficult to obtain porters to unload heavy cases.

In recent years there has been an increasing trend towards road transport for the delivery of goods from all of Boots' warehouses, and it is estimated that at present 70% of deliveries to branches from Nottingham and Beeston are by road and 30% by rail. At present 974 of the 1,300 branches are supplied by road.

Boots report a big improvement in rail transit times and are successfully operating three regional schemes where rail waggons are sent to a main centre and the goods distributed over a wide road

network from that point.

Some 40 lorries are loaded each night at the Beeston docks. Of these, half are Boots' lorries and the remainder are hired and operated by contractors who do most of the two- or three-day trips.

Industry's Publications

Diagnosing occupational diseases. A revised edition of Notes on the Diagnosis of Occupational Diseases has now been published by H.M.S.O. The booklet contains notes on the diseases which have been prescribed by the Minister of Pensions and National Insurance and for which benefit is avilable under the National Insurance (Industrial Injuries) Act, 1946. Intended primarily for the guidance of medical practitioners dealing with claimants under this Act, the notes, although not exhaustive and not concerned with treatment, should be of use to other practitioners, and it is hoped that their publication will stimulate a wider interest in the whole field of occupational medicine.

Borates in adhesives. Technical Service Bulletin No. 17 issued by Borax Consolidated Ltd. deals with the use of borates in adhesives and sizes. The use of borates in casein, starch and dextrin adhesives, animal glues and natural resins and gums is discussed and simple formulæ are given.

Evans Medical Supplies Ltd. The House of Evans was founded in 1809 by John Evans of Worcester. Today a wide range of medical and veterinary products are manufactured at its headquarters at Speke, near Liverpool. The Evans Biological Institute and Evans Fine Chemical Works are situated at Runcorn, Cheshire. A new booklet briefly tells the story of the company.

Biological stains and reagents. The complete range of biological stains and reagents and scientific dyestuffs available from G. T. Gurr Ltd. are described in the 1959 price list.

New data. Information on cosmetics, emulsifiers, pharmaceutical products and soaps is given in a recent issue of the *Croda Users' Digest*. The digest is intended to supply up-to-date information taken from many sources on the latest uses of the company's products.

Chemical plant. The Power - Gas Group designs, manufactures and erects plant and equipment for a wide range of industries including the chemical industry, and they have now issued a profusely illustrated booklet, printed in English, French, German and Spanish, which describes the various divisions of the Group and the industries with which they deal.

Measuring refractive indices. The Hilger Abbe refractometer finds many uses in the industrial laboratory for confirming analyses, checking purity and determining concentrations. A pamphlet published by Hilger and Watts Ltd. gives specifications of the instruments and describes the method of use.

Tertiary amines. Ethomeen is the registered trade name of a group of tertiary amines obtained by condensing an aliphatic amine with ethylene oxide. Though cationic in character, several of the Ethomeens react like nonionic

compounds; they are all surface active and have many industrial applications. Depending on the type of amine used and the number of ethylene oxide molecules added to the amine, a large range of *Ethomeens* can be made, each with its specific characteristics and applications. Bulletin No. L-25, issued by Armour Chemical Industries Ltd., describes the principal characteristics and typical applications of the products.

GERMAN CONGRESS

(Continued from page 470)

- 12. "A Contribution to the Study of several Organ-Extracts," by J. Cotte.
- "The Hardness of Creams," by I. Hajdu.
- 14. "The Temperature-dependent Consistency Change of Soap Gels," by L. W. Marsch and B. Ehring.
- "Possible Methods for the Objective Measurement of the Colour of Cosmetic Preparations," by R. Blanke.
- "Microscopic Investigations of the Dyeing of Hair," by S. Preisinger.
- "On Novel Cross linking Reactions in Hair involving the Use of Bunte Salts," by A. Schöberl and G. Bauer.
- "On Disulphide Exchange Reactions in Small and Large Molecules," by A. Schöberl and H. Grätje.
- 19. "On Testing Glass according to DAB.6" (Deutsches Arzneibuch), by G. Everts.
 20. "The Interference of Nonionic
- 20. "The Interference of Nonionic Emulsifiers with Preservatives, VIII," by Maison G. de Navarre.
- 21. "New Investigations on the Secretion of Sweat," by R. Brun.

Synthesis and Applications of Acyl Halides—2

By Greville Machell, B.SC., PH.D., A.R.I.C.*

In the first part of his article published last month, Dr. Machell discussed the preparation of acyl halides from acids and their derivatives. In this second and concluding part he considers other methods of preparation and concludes with a review of the industrial uses of acyl halides.

Preparation from hydrocarbons and their derivatives

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MANY paraffin hydrocarbons can be converted to acyl chlorides by direct substitution of a hydrogen atom by the chloroformyl group, —COCl. This conversion is achieved by subjection of a mixture of the hydrocarbon with oxalyl chloride to the action of either actinic light or organic peroxides at room temperature. As would be expected under these conditions, the ensuing reaction is of the free radical type, and its discoverers, Kharasch and Brown, 25 have put forward the following chain reaction mechanism:

1.
$$(COCI)_2$$
 light

2. $COCOCI + CI$

2. $COCOCI \rightarrow CO + CI$

3. $COCOCI \rightarrow CO + CI$

4. $RH + CI \rightarrow RC + HCI$

5. $RCOCCI \rightarrow COCI (\rightarrow etc.)$

n-Pentane, n-heptane, isooctane, cyclohexane and methylcyclohexane have been found to afford one mol. of acyl chloride for each mol. of oxalyl chloride which reacts, although the actual conversion of these hydrocarbons varies from 5-50%. By operating at higher temperatures these yields can be improved considerably.

Attempts to extend this method to the aralkyl hydrocarbons have met with little success. Thus on refluxing toluene, xylene, etc., with oxalyl chloride for 24 hr. in the presence of actinic light there was virtually no formation of the corresponding acyl chloride. This lack of reaction has been ascribed to the quenching of the radiation by the aromatic nucleus. By the use of benzoyl peroxide as catalyst instead of light under otherwise similar conditions, there was an 8% conversion of toluene to phenylacetyl chloride:

and other aralkyl hydrocarbons behaved similarly. Under these conditions, however, paraffin hydrocarbons are converted to the acyl chlorides in practically quantitative yields. It is suggested that the much lower yields obtained with the aralkyl hydrocarbons are due to the comparatively low reactivity of the corresponding aralkyl radicals.

With both paraffins and aralkyl hydrocarbons no reaction takes place with oxalyl chloride in the absence of light and peroxides, even on prolonged boiling. In contrast, the reaction of unsaturated hydrocarbons with oxalyl chloride is not influenced at all by the presence

* British Rayon Research Association

of light or peroxides, and occurs when the reactants are merely refluxed together. Two distinct modes of reaction have been found,²⁷ according to the nature of the unsaturated hydrocarbon, but in both cases a polar mechanism must apply owing to the lack of light or peroxide effects. With 1,1-di-phenylethylene, styrene, a-methylstyrene and 1-methylcyclohexene, the yields of the corresponding acyl chloride varied from 50 to 6% in the same order:

$$\begin{array}{c} R \\ \\ R' \end{array} C = CH_a + (COCI)_a \longrightarrow \begin{array}{c} R \\ \\ R' \end{array} C = C \\ \begin{array}{c} \\ COCI \end{array} + CO + HCI \\ \end{array}$$

In the case of phenylacetylene, the following reaction occurred:

$$PhC \equiv CH + (COCI)_2 \longrightarrow PhC = CCOCI + CO$$

It has been established that for an unsaturated hydrocarbon to react with oxalyl chloride the unsaturated link must be highly polarised, as it is particularly in 1,1-diphenylethylene. Unsaturated hydrocarbons without this feature—cyclohexene, stilbene and 1,2-dichloroethylene—show no reaction.

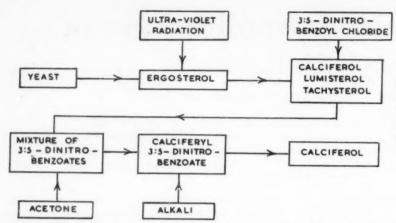
Similar reactions to those discussed above are also given by oxalyl bromide, when the acyl bromides are produced. The oxalyl halides can also be replaced by carbonyl chloride, carbonyl bromide or by a mixture of carbon monoxide with chlorine or bromine, when the acyl halide is still produced.²⁸

Aliphatic acyl halides can be prepared from an alkyl chloride by adding one atom each of carbon and oxygen. This is achieved by treating the alkyl chloride with carbon monoxide, carbonyl chloride or carbonyl sulphide (COS) under pressure at elevated temperatures in the presence of metal catalysts such as copper. In this way methyl chloride may be converted to acetyl chloride:²⁹

A similar reaction with carbon monoxide is also given by polychloroalkanes such as carbon tetrachloride, methylene dichloride, and pentachloro-ethane, in the presence of aluminium chloride: e.g.

$$CCI_4 + CO \longrightarrow CCI_3COCI$$
 $C_2HCI_5 + CO \longrightarrow C_2HCI_4COCI$

Tetrachloro-ethane under the same conditions affords a mixture of trichloro-propionyl chloride and dichloroacrylyl chloride, the latter presumably arising by loss of hydrogen chloride from the former. These polychloroacyl chlorides are useful intermediates in the



An example of the use of an acyl halide for intermediate ester formation is to be found in the manufacture of calciferol (vitamin D-), as shown in the flow diagram. Here the separation of calciferol from the other irradiation products depends upon the low solubility of calciferyl 3:5-dinitrobenzoate in acetone.

Flow sheet by courtesy of Glaxo Laboratories Ltd.

manufacture of pesticides, rubber chemicals, dyes and medicinals, 30

Benzoyl chloride can be prepared from chlorinated toluenes; for example, controlled hydrolysis of benzal chloride, PhCHCl₂, followed by chlorination at 120°-150°C. produces benzoyl chloride in 90% yield. The by-products, PhCCl₃ and benzoic acid, are removed by distillation. It is possible to replace the pure benzal chloride by a mixture of this compound with benzyl chloride and benzoic acid, and chlorinate directly in the presence of a catalyst.³¹

Benzene derivatives containing two trichloromethyl groups in *meta* or *para* positions (and prepared for example by chlorination of the appropriate xylenes) can be saponified using one mol. of water for each trichloromethyl group to be converted, in the presence of a catalyst which favours hydrogen chloride elimination.³² Thus, terephthaloyl chloride is prepared from *p*-bis-(trichloromethyl)-benzene:

In a variation of this procedure, one mol. of a polycarboxylic acid, its ester or its salt, is reacted under the above conditions with one mol. of the polytrichloromethyl compound corresponding to the acid. The basic reaction involved here is:³³

Miscellaneous preparations

There are several preparations of acyl halides of a special nature which cannot be included under the foregoing headings, and details are now given of two of these. β -Alkoxyacyl halides may be prepared by the treatment of an a-halogenated aliphatic ether with ketene or its spontaneously formed dimer, diketene. The latter two highly reactive compounds are obtained from the pyrolysis of acetone or acetic acid, and this reaction with an ether derivative such as chlorodimethyl ether may be formulated thus:

A suitable catalyst for this condensation reaction is aluminium chloride, and methane is used as a diluent. The product in the above example is β -methoxypropionyl chloride.³⁴

Unsaturated acyl halides are produced by the halogenation of an unsaturated aldehyde in which an olefinic carbon atom is linked directly to the carbonyl group. The novelty in this preparation lies in the substitution of the formyl hydrogen atom being preferred to addition at the double bond under the temperature conditions used (200°-600°C.). For example, a mixture of acrolein and chlorine is passed through a heated tube, and the hydrogen chloride produced absorbed by passage through water. A good yield of acrylyl chloride is obtained:³⁵

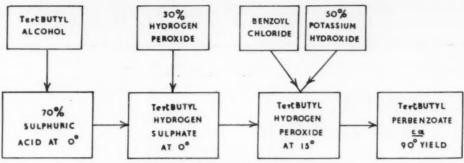
 α -Methylacrylyl chloride has been obtained in the same way, and the bromine analogue by using bromine instead of chlorine.

Applications of acyl halides

Attention is drawn to a recent extremely comprehensive review compiled by Sonntag, ³⁶ of the wide variety of reactions of the aliphatic acyl chlorides, in which however it is inevitable that the actual applications of these compounds have been hidden amid an immense collection of experimental data of a largely academic nature. The review mentioned does not cover the aromatic acyl halides, but these compounds appear to have less application than their aliphatic counterparts.

The halogen atom in acyl halides is readily replaced by other groups, the ease of replacement falling off in the order: chloride > bromide > iodide, which is the reverse of that found in the alkyl halides. One of the most useful reactions involves replacement of the halogen by the amino-group, which is brought about simply by treating the acyl halide with ammonia:

This process is known as ammonolysis, and the amides produced have been used as waterproofing agents, sizes, plasticisers, as well as intermediates for the preparation of other derivatives such as nitriles. Analogous to the above reaction is that occurring with amines, and affording substituted amides, which are of considerable industrial importance. With primary amines, R'NH₂, the products are of the type RCONHR', which are of value as wetting and foaming agents, detergents, adhesives and dyes, to mention but a few examples. Treating polyamines such as ethylenediamine successively with long and short chain acyl halides produces fatty polyamides such as



Manufacture of tert butyl perbenzoate

 $CH_3(CH_2)_{16}CONHCH_2CH_2NHCOCH_2CH_3$ (from steary) and propionyl chlorides) which are useful as textile lubricants and softeners.³⁷

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Second only in importance to reactions with amines are the esterification reactions of acyl halides with hydroxy-compounds of many kinds. Ester formation takes place readily with primary and secondary alcohols at room temperature:

and the reaction is not reversible as is the case when forming esters from the free acid and the alcohol. Furthermore, the mild conditions are a strong recommendation where heat-sensitive alcohols are concerned. The esters produced from simple alcohols have many applications, but of even greater importance are those made from polyhydric alcohols such as glycerol and long chain fatty acyl halides. For complete esterification, it is usual to introduce a hydrogen chloride acceptor into the system, suitable examples being the tertiary amines, such as pyridine or triethylamine. A comprehensive review of polyesters has been given elsewhere,38 so that a few brief notes will suffice here. These esters find use as plasticisers, wetting agents, detergents, emulsifying agents, lubricants, drying oils, fat and oil substitutes and improvers, and there are literally hundreds of patents referring to their use in these and other connections.

Acyl halides will react with the corresponding acid or its salt to produce the anhydride:

the reaction being facilitated by removal of the hydrogen chloride when the free acid is employed. This reaction is general for acids of lower mol. wt. only. Acetyl chloride has been used in the synthesis of dicarboxylic anhydrides such as glutaric, excellent yields being obtained:39

Acyl chlorides react with inorganic peroxides to yield acyl peroxides, acetyl peroxide being obtained by treating a solution of acetyl chloride in an inert solvent with barium peroxide:

$$\begin{array}{c} 2CH_3COCI + BaO_2 \longrightarrow CH_3CO.O + BaCI_2 \\ & \downarrow \\ CH_3CO.O \end{array}$$

Organic peroxides have been mentioned earlier as

catalysts for free radical reactions, and they are used commercially as polymerisation accelerators, bleaching agents and as constituents of various pharmaceutical and cosmetic preparations. The reaction of acyl chlorides with the stable tertiary alkyl hydroperoxides has been reported recently:40

$$RCOCI + (R')_3COOH KOH (R')_3COOCOR + KCI + H_2O$$

and the tertiary per-esters produced, which are stable oxidising agents, have found a number of applications as germicides, polymerisation accelerators and bleaching agents.

Friedel-Crafts synthesis

Acyl chlorides undergo an important reaction with aromatic hydrocarbons in the presence of aluminium chloride; acylation of the hydrocarbon takes place, and this is the basis of the well-known Friedel-Crafts synthesis of ketones: e.g.

$$C_6H_6 + RCOCI \longrightarrow C_6H_5COR + HCI$$

With olefins and acetylenes, the reaction is usually one of addition: e.g.

$$CH_2=CH_2+RCOCI-\longrightarrow RCOCH_2CH_2CI$$

 $CH\equiv CH+RCOCI-\longrightarrow RCOCH=CHCI$

although other modes of reaction have been reported. The literature contains a host of examples of these types of reactions, and an exhaustive account of them is already available.41

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PROGRESS REPORTS

PERFUMERY and Essential Oils

By G. B. Pickering, M.A., D.PHIL., A.R.I.C.

Cineole • Determination of aldehydes and ketones • Mint oils • Molecular refraction

Cineole in lavender oil

THE cineole content of lavender oils is a matter of great interest. Genuine French lavender oil (Lavendula officinalis Chaix) contains at most only traces, whilst (Lavendula intermedia) oil that the odour differs from that of highgrade French oils, lacking their sweetness and being more cineole-like and camphoraeeous. Spike lavender (Lavendula latifolia Vill) is again harber and more camphoraeeous and has a much higher content of cineole.

The ortho-cresol method is unsuitable for determining cineole in these oils, since the presence of other oxygenated constituents (esters, alcohols, aldehydes and ketones) raises the freezing point of the ortho-cresol compound and indicates a higher result than the actual cineole content. Other methods are subject to similar disadvantages. If a quantitative method of gas chromatography could be devised for this purpose it would seem to be an obvious choice, but meanwhile an interesting new method based on infra-red spectrophotometry has been published.²

Pure cincole shows characteristic absorption peaks in the infra-red at 1,310 cm.⁻¹, 1,220 cm.⁻¹, 1,085 cm.⁻¹ and 855 cm.⁻¹ which enable it to be detected in lavender oils, the last two of these bands being due to the asymmetric and symmetric vibrations respectively of the C—O—C linkage. The peak at 1,085 cm.⁻¹ was selected for quantitative work and 2.5% w/v solutions of lavender oil in carbon disulphide, which has a low absorbance in this region, were

used for the determinations. These solutions were examined in a double beam recording spectrophotometer, the sample cell having a path length of 0.500 mm., whereas the reference cell, containing only carbon disulphide, was adjusted to a path length of 0.485 mm. to compensate for the volume of oil present and thus to maintain the double beam balance.

Since the selected peak was superimposed on a sloping background absorption due to other components of the oils, a simplified "absorbency difference" method was used to correct empirically for this. Using solutions of cincole in carbon disulphide up to concentrations of cincole above those which would be present in a 2.5% w/v solution of lavender oil, a plot of concentration against "absorbency difference" gave a straight line through the origin indicating that Beer's Law applied in this concentration range.

A sample of English lavender oil was assayed a total of six times to check the reproducibility of the method and gave results from 11·2% w/w to 11·6% w/w with an average cincole content of 11·4% w/w.

A similar order of accuracy was obtained on mixtures prepared from

a French lavender oil of known, 1%, cincole content, to which known amounts of pure cincole had been added, thereby raising the total cincole content to about 7% and higher.

A series of 25 lavender oils, French, English and spike, were assayed for cincole by the infra-red method and in certain instances for "apparent cincole" by the "cresineol" method. A few typical results are shown in Table 1.

In conclusion the authors state that although in the past the quality of lavender oils has often been based on the ester content, by the present method it is possible to identify also the commercial oils by their cineole content. French oils contain little or no cineole, English oils up to 13% and the spike lavender oils from 22 to 31% of cincole. It is suggested that some French oils of the cheaper grades, which contain a few per cent. of cineole, have been produced by blending with oil from L. hybrida (lavendin) to sell at a lower price. It is admitted, however, that a larger range of genuine oils must be examined before the cineole content of the official lavender oils can be made a basis of general classification.

Spectrophotometric assay of aldehydes and ketones

A new method has been proposed for the determination of α,β -unsaturated aldehydes and ketones (e.g. citral, cinnamaldehyde, carvone) in essential oils, which is claimed to be specially suitable for those oils, such as cinnamon leaf oil, where only small quantities of these compounds occur. It is based on reaction with Girard-T reagent to form the corresponding hydrazone

 $R_1R_2C = N.NH.CO.CH_2N(CH_3)_3$ followed by measurement of the absorption due to this compound

Cineole per cent. w/w

Table 1.—Cineole Assay of Lavender Oils

Sample No).				Туре	by infra-red	by " cresineol " method	
2				Fr	ench	less than I	23	
9	***				nglish	11-8	28	
11	***			Er		9-2	-	
20	***			Sp	ike	24-1	32	
25	***		***	Er	nglish special	less than I	_	

in the ultraviolet region. In the case of saturated carbonyl compounds the absorption of these derivatives occurs in the region 230 to 240m μ where there is some absorption due to the reagent itself, but the Girard-T hydrazones of the a,β -unsaturated carbonyl compounds absorb above 265 m μ where there is no interference.

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For the determination of citral or cinnamaldehyde a weighed quantity of the oil is boiled under reflux with the Girard-T reagent in ethanol and the resulting mixture after dilution with ether is extracted with water several times. The aqueous extract, which contains the Girard-T hydrazone, is made up to a standard volume and aliquot suitably diluted to obtain the correct optical density for measurement in 1 cm. cells at the wavelength of peak absorption (281 $m\mu$ for that of cinnamaldehyde).

From the value of E (1% 1 cm.) obtained by carrying the procedure on the pure isolate the percentage of the carbonyl compound can be

The procedure is similar for carvone, but a 10% solution of acetic acid in ethanol and a longer period of boiling are necessary to effect reaction (λ max, for the carvone compound 272.5 m.).

Comparisons of the results with those obtained by the well-known hydroxylamine hydrochloride method showed that use of the Girard-T reagent was an advantage with cinnamon leaf oil where the presence of only a small amount of cinnamaldehyde made assay difficult; whilst with lemon oils use of the Girard-T reagent gave lower results than hydroxylamine hydrochloride method presumably because other carbonyl compounds (citronellal and methylheptenones) present in the lemon oils were not estimated in the former method.

Variations in oils within a single mint plant

In an attempt to gain new insight into the processes of oil formation in mint plants, Reitsema, and his colleagues the A. M. Todd Co., Kalamazoo, Michigan, have examined the difference between oil from the newer leaves and that from the old leaves of single plants.⁴

Actually leaves from three locations on the plant were examined; these were leaves on the central stem at the bottom of the plant,

Table 3.—Constituents of Oils from Leaves from Various Parts of Peppermint Plant

Area of	Location	Size of chromatographic spot (sq. in.)				
(sq. in)	Plant	Menthone	Pulegone	Pipertone area		
4-8	A	0.07	0-11	0-12		
3.9	В	0.19	0-16	0.05		
1.6	C	0.20	0.11	_		

which were the oldest (location A); those on the same stem but nearer the top (location B); and the newest leaves, those at the top (location C). The areas of leaves from each location were measured with a planimeter and 3 to 6 sq. in. of leaf area were required to provide enough

oil for chromatography.

The leaves were ground in a mortar with a little sand, 2 ml. of hexane, and enough water to cover The ground mixture was them. poured into a 50 ml. flask and about 15 ml. of water was used to rinse the contents into the flask. After adding a foam inhibitor, the mixture was steam distilled, using a short condenser, into a 30 ml. separatory funnel containing 1 ml. hexane. About 10 ml. of condensate was collected, the condenser rinsed down with 2 ml. of hexane and this hexane used to extract the aqueous layer. The combined organic lavers were evaporated almost to dryness.

The whole sample prepared in this way was used for the chromatoplate, identification of the spots being made through the three-step sequence of fluorescence, colour with acidic dinitrophenyldrazone spray, and subsequent heating. Certain compounds such as menthol were detected by the fluorescein-bromine With chromatoplates prepared under uniform conditions, the areas of the spots, as measured with a planimeter, were a direct function of the amount of material placed on the chromatoplate, as the Table 2 shows.

Using this technique it was found that difference existed between oils from the different locations on the single plant — particularly with

Table 2.—Area of Chromatogram Spots in Square Inches for Increasing Amounts of Various Materials

		Amount of material used			
Compound		12	12.	12	2λ
Pinene	***	_	-	0.21	0.40
Menthone		0.09	0.20	0.41	0.69
Pulegone		0.6	0.10	0.22	_
Menthofuran		G-14	0.21	0.39	-
Carvone		_	0.32	0.47	_

rapidly growing plants—and were so great that in many cases the minor constituents of one oil sample were actually the major ones in other oils. The newer leaf areas yielded a much higher percentage of oil per unit leaf area than the older areas.

The variations in the amounts of the different constituents of the oil with the three locations in the peppermint plant are illustrated in Table 3.

There was a progression from high pulegone in the newest leaves to menthone predominance in older leaves. The next logical step in the process—conversion of menthone to menthol—could also be observed.

Spearmint oil was studied in the same way. Comparison of the older leaves with the newer showed that dihydrocarvone increased in the former at the expense of carvone. Thus oil from relatively new leaves of a spearmint plant (2.8 sq. in. from location B) gave a 0.23 sq. in. carvone spot and a 0.06 sq. in. dihydrocarvone spot. Oil from an older leaf area (3.0 sq. in. from location A) gave only 0.10 sq. in. for carvone, whilst the dihydrocarvone spot had increased to 0.09 The terpene hydrocarbon sq. in. spot had decreased from 1.0 to 0.5 sq. in. in going to the older leaf

These progressions from the unsaturated and ketonic to the saturated and alcoholic type of constituents are in agreement with the results observed from comparison of oil distilled early in the season with that from late harvests.

Piperitenone and diosphenolene

As previously reported,⁵ R. H. Reitsema in the course of his researches on mint species has found that the major constituent of *M. rotundfolia* is piperitenone oxide (1,2-epoxy-4 (3)-p-methane-3-one) (I).⁶ Associated with this keto oxide in the oil, and readily obtainable from it in the laboratory, was a new enolic ketone called diosphenolene for which the structure of

3-hydroxy-3,8 (9)-p-menthadiene-2one (II) was proposed.

The double bond in piperitenone oxide was assigned to the 4:8 position (isopropylidene group) on the basis of chemical and spectroscopic evidence. In diosphenolene the double bond was taken to have shifted to the 8:9 (isopropenyl This was postulated position). particularly on the basis of the ultra-violet absorption maximum at about 306 mg which corresponded to that calculated for the system $C = C - C = C(OH) \cdot C = O$. In the infra-red, diosphenolene shows a strong absorption at 884 cm. 1 in agreement with the presence of an isoprepenyl group, whilst absorption at 825 cm. due to the isopropylidene group is absent. There is absorption at 1,604 cm. 1 in agreement with the presence of a conjugated C=C group. Further evidence for the structures of these two compounds has now been provided by synthesis.7

Racemic piperitenone oxide was prepared by simply treating a sample of piperitenone with alkaline hydrogen peroxide. The semicarbazone of the keto oxide so prepared was identical with that of the active piperitenone oxide from M. rotundifolia except for minor differences in the infra red spectra ascribed to the use of the pelletised KBr method for this purpose.

Diosphenolene could be prepared by treatment of piperitenone oxide or its semicarbazone with dilute acid and by various methods from pulegone. The most useful synthesis of diosphenolene from pulegone was a modification of the method used for the preparation of diosphenol from menthone.8 Treatment of pulegone(III) with mercuric acetate gave 2-acetoxypulegone (IV), but when this was hydrolysed by heating with 8% aqueous potassium hydroxide solution rearrangement and oxidation took place in the presence of excess alkali and diosphenol (V) was produced. To avoid this reaction, the acetoxypulegone was hydrolysed using 1% carefully potassium hydroxide at lower temperature. The resulting hydroxypulegone (VI) was then oxidised to diosphenolene (II) under mild conditions (bismuth oxide in glacial acetic acid at 110°). The product from this synthesis was identical with authentic diosphenolene.

Molecular refraction re-examined

Terpenes and their derivatives exhibit a variety of isomerism and newer spectrographic techniques have been invaluable for distinguishing between the isomeric forms, the identification of isopropenyl and isopropylidene structures from their infra-red absorption spectra being now almost a classic example. It is often useful, however, to reexamine techniques which are less specialised and do not require such expensive apparatus. Molecular refraction is one of these, and Luz Oliveros-Belardo and Paul Jannke⁹ have recalculated this constant for a number of monoterpenes of various structures using specially pure compounds for the determination of the refractive index and The actual molecular density. refraction was calculated from this data using the n2 formula of Lorentz and Lorenz, whilst the theoretical molecular refractions were obtained by summation of the atomic refractions for the D-line determined by Bruhl and Conrady.10 As is well known, the simple sum of the appropriate values may not agree with the experimentally found values; the latter may be higher due to a double bond conjugated with a cyclic structure, a side chain or another double bond.

The three p-menthadienes examined, (VII) a-phellandrene, (VIII) a-terpinene and (IX) 3,8,-p-menthadiene all showed marked exaltation and this was greatest with 3,8-p-menthadiene where conjugation occurs between an exocyclic double bond and one ring.

(III)

Where a double bond is in conjugation with a cyclic system as in α -pinene (X), β -pinene (XI) and sabinene (XII), exaltation again occurs. Comparison of a-pinene for which the exaltation is low, with β-pinene, which has a considerably higher exaltation, again shows the superior effect of an exocyclic double bond in increasing exaltation. Sabinene, where an exocyclic double bond was conjugated with a evelopropane ring, gave the largest difference.

The authors consider that the isopropyl group exerts an exalting influence on the double bond nearest

This is said to be the explanation of the greater exaltation of aterpenene (VIII) when compared with a-phellandrene (VII).

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DISINFECTANTS and Disinfection

By A. H. Walters, F.I.M.L.T., M.R.S.H., M.I.BIOL.

Syringe infection • Syringe sterilisation by radiation • Gum tragacanth and preservatives . Salicylic acid derivatives as fungistats • Clorpactin as a bactericide • Sonic disruption of azotobacter • Sugars as inhibitors • Warexin

Syringe infection

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A SURVEY for a central syringe service has recently been carried out under the ægis of the Ministry of Health.1 Mention is made of the fact that the initiation and pursuit of such a service has been to some extent prompted by episodes of greater or lesser tragedy. Since 1876 there have been references in medical literature to cases of tetanus arising from accidental contamination of syringes used for hypodermic injection. In 1938 there was an outbreak of streptococcal infection among a hospital nursing staff as a sequel to immunisation with T.A.F. against diphtheria. On this occasion it was concluded that the infection had been introduced from a nursing sister's hands which contaminated a bowl of saline in which the syringes and needles had been rinsed. In 1939, following inoculation of school children with T.A.F., one child died and three others developed tuberculous lesions at the site of inoculation and elsewhere. This was thought to be due to the use of infected syringes. In 1940 it was shown that treatment with alcohol and ether cannot be relied upon to sterilize syringes, and also that during assembly and carriage contamination can occur. In 1943, further work showed that hepatitis following the administration of novarsenobenzol appeared to be due to the use of the transmission of bloodborne virus from the patient to another by unsterile syringes. Other workers considered that the practice of using previously sterilised or filtered water for rinsing syringes and needles could not be too strongly condemned and recommended boiling or sterilisation either

by oven or autoclave, the syringes being assembled and contained in plugged test tubes. The M.R.C. Memorandum No. 15 officially supported this view with certain Since the last war, provisos. in hospitals particularly, the trend has been definitely towards central syringe cleaning and sterilisation using sealed metal cartridges as containers. The survey now reported examines the demand for such a service being extended over an area and involving general practitioners. All sizes and all uses of syringes have been carefully considered. The survey might be looked upon as a very useful essay in applied bacteriology.

In any advance of this kind much work by early pioneers must of necessity be overlooked. Your reviewer recalls the use of hot-air sterilised syringes in sealed metal cartridges being a feature of the bacteriological department of at least one London teaching hospital some 30 years ago, and the method was possibly in use elsewhere well before that time. But the era of the "boiled up" syringe in "sterile water" being assembled with ungloved hands before use has by no means passed, many nurses and doctors not realising that the skin of washed hands when wet can release a bacterial flora which may dangerously infect syringes and needles.

Sterilising syringes by radiation

The demand for sterile syringes in hospitals has given rise to the establishment of central syringe services on an increasing scale. The Medical Research Council have officially recommended hot air for syringe sterilisation, but despite this in many places autoclaving

and even boiling water is still most commonly used. Darmady and Hughes^{2,3} have severely criticised the use of the autoclave, pointing out that it is difficult for steam under pressure to penetrate between the plunger and barrel of an assembled syringe. These workers have also shown that hot air ovens may not be efficient unless fitted with fans to circulate the hot air and so evenly distribute the required temperature. A further report has now been issued4 describing a radiation method for sterilising syringes. These are loaded in single layers on to trays and by means of a conveyor belt taken through a chamber containing electric infra-red projectors. The belt travels at 4 in. per min., which permits full loading, and the syringes are exposed to 180° for 11 min. The authors consider that ease of operation justifies the cost

of the apparatus.

this apparatus, Undoubtedly which your reviewer has seen in action, together with the routine throughput methods used, ensures. a factory production line for sterilising syringes in the shortest possible time, and it might well be considered for the larger units. In smaller places, where initial capital cost might prevent its installation, some thought might be given to rendering the syringe in as clean and sterile a condition as possible before final sterilisation. Recently some ad hoc tests in a London teaching hospital using Deogen (a liquid detergent-steriliser) for initial cleaning of syringes before final rinsing showed that the degree of residual contamination on the syringes before final sterilisation was minimal; in many cases the syringes were sterile before final sterilisation. Your reviewer suggests that if more attention were paid to the cleaning and disinfection (one operation) of the syringe the risks attendant on final sterilisation whatever means employed would be effectively minimised.

Gum tragacanth and preservatives

During an experiment on a pharmaceutical jelly preserved with 0.5% chlorbutanol and 1:50,000 phenylmercuric acetate it was found that the antibacterial activity of the product was surprisingly low.5 This suggested that the gum tragacanth in the product was interfering with the action of the preservatives. Such a possibility might have im-

portant implications for manufacturers of preserved or self-sterilising jellies. Accordingly various concentrations of chlorbutanol, phenylmercuric acetate, merthiolate, a mixture of methyl and propyl-phydroxybenzoates, benzylkonium chloride and phenol were dissolved in 3.0% gum tragacanth and tested over periods ranging from 10 minutes to several days for their antibacterial activity against Staph. aureus (approximately one million organisms per ml. of sample). All preparations were maintained at pH 7.0 with M/15 phosphate buffer, a solution which did not interfere with the tests. The mercurials were neutralised by the use of 0.03% thioglycollate agar and Tamol N was used to stop the action of the quaternary tested. Results showed that in spite of presumably effective concentrations of chlorbutanol, the p-hydroxybenzoates, and benzylkonium chloride, the presence of gum tragacanth markedly reduced their respective antibacterial activities, and the same was true to a lesser extent in the case of phenol, phenylmercuric acetate and merthiolate. Resistance to contamination with S. aureus appeared to decrease the longer the gum has been in contact with the antibacterial substances. For instance, a fresh 0.5% chlorbutanol jelly could destroy all test organisms in three hours, but the same jelly, 10 days old, would permit 25% survival of S. aureus infection. The authors suggest it is highly probable that other vegetable gums such as methocel, Irish moss and carboxymethylcellulose may also reduce the activity of antibacterials used as preservatives for pharmaceutical iellies.

Caprylate in sterility testing

Bacteriologists are familiar with problems of neutralising disinfecting agents when testing for antibac-Recent work terial activity. draws attention to the fact that the addition of fungicidal or fungistatic agents to injectable products presents a problem to laboratories conducting sterility control tests, because contaminating moulds and yeasts may have their growth inhibited by an added antifungal agent. A dental paste containing 200 mg. (per cartridge) of sodium caprylate was first tested by the U.S. Food and Drugs Administration method, and from results

obtained it was thought that this technique would not reveal mould contamination if present.

Accordingly the antifungal activity of sodium caprylate was tested in Sabouraud's medium (liquid U.S.P.) at final pH 5.7. Various concentrations of sodium caprylate were added between 25 and 300 mg. per 100 ml. of medium. The test organism was a sensitive sporulating strain of penicillium used at test concentrations ranging from 2 to 2 million spores. The tubes were incubated at 25°C. up to 10 days. Tubes containing more than 200 mg, caprylate showed no growth, but spores could be recovered sometimes from weaker concentrations. In the tubes containing 25 mg. growth occurred in all tubes on the third day. Later tests using thioglycollate medium at pH 7·1 gave better results. Then Sabouraud's liquid medium was again tried using pH levels between 5.8 and 7.4 after sterilisation. The best results were obtained at pH 7.4. It was found that spores growing in such a medium for 10 days produced acid which progressively lowered the pH of the medium. By setting the pHat 7.4 recovery rate of spores to germination was greatly increased.

It was concluded that the present official FDA test is inadequate for recovering moulds from products containing sodium caprylate, but if the pH of the medium in the official method is changed from 5.7 to 7.4 contaminating mould spores can be almost completely recovered.

Fungistats

A series of 2-alkoxy derivatives of benzamide, halogenated benzamides, 3-naphthamide and Nsubstituted benzamides have been prepared and tested in vitro as potential antifungal agents.⁷ The compounds were dissolved in a "self-sterilising" solvent consisting of ethanol (70 vol.), propylene glycol (5 vol.) and distilled water (25 vol.) to give a concentration of 1.0% w/v. These solutions were serially diluted in Sabouraud broth and aliquots transferred to molten malt agar to give final concentrations within the range of 50-1.5 m.g./ml. The highest concentration of ethanol incorporated in the dilution plates was 0.35% v/v which had previously been shown to exert no fungistatic effect. Test plates were inoculated by implanting

a small portion of mycelium not exceeding 2 mg. in weight from a 10 to 17 day old stock culture of the fungus under test. With M. audouni and T. tonsurans it was necessary to lift the mycelial mat from the surface of the agar before cutting off pieces for test plates. Cultures were incubated for 7 days at 25° to 28°. The highest dilution of a compound which prevented growth of the fungus was recorded as the inhibitory concentration. For fungicidal tests 1 sq. cm. plaques cut from a 10-day culture of T. mentagrophytes on an agar plate were immersed in sterile horse serum for 15 sec. and then transferred to 5 ml, amounts of dilutions of the compounds in Dubos broth for 1 hr., 1 day and 5 days. After exposure the plaques were immersed in 30% v/v aqueous acetone for 10 min. and then transferred to 20 ml. of Sabouraud broth. Finally the plaques were placed aseptically on to malt agar plates which were incubated for 14 days at 25° to 28°. Results indicated that 2-n-amyloxybenzamide to be the most active of the derivatives studied. It appears to be comparatively slow acting but has a greater fungistatic activity than undecylenic acid, N-n-butyl-3-phenyl-salicylamide, salicylanilide, Nystatin, phenylmecuric acetate, sodium ethylmercurithiosalicylate and 8hydroxyquinoline.

Some workers might consider the test techniques rather severe since adequate penetration of mycelial mats is very difficult.

Clorpactin as a bactericidal wash

In a recent paper from the U.S. it is stated that the several reagents bearing the trade designation Clorpactin are described as derivatives of monoxychlorosenes which liberate active chlorine as hypo-chlorous acid. Approximately 25% of the formulation consists of Clorpactin, which is given as a hydrocarbon composed of a chain of approximately 14 carbons containing an OCI group linked to the end of a carbon atom. In addition a sulphonate group is attached to a point along the chain to increase the hydrophilic nature of the compound. The remaining 75% of the formulation is made up of buffers and stabilisers that sustain the action of liberated hypochlorous acid.8 Claims have been made that Clorpactin WCS-90

approaches the ideal germicide and that its application has been found effective in the treatment of ear, nose and throat conditions and genito-urinary infections, and also in the preoperative treatment of skin. Laboratory tests indicate antibacterial activity over a wide spectrum and its viricidal power has been demonstrated against the poliomyelitis virus. In addition its non-toxic and non-irritating properties have prompted research into its use as a bactericidal wash for crab and oyster meats.

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Clorpactin WCS-50 (food grade) is described as a fairly free flowing water soluble white powder. Concentrations of the order of 0·14, 0·28 and 0·56% were prepared in tap water. For crabmeat tests 0·28% solution only was used, but all three concentrations were employed in the oyster washing tests. 75 g. samples of crab meat were wrapped in cheesecloth and immersed in Clorpactin solutions up to 30 min. time intervals. Agitation was continuous to facilitate dispersion

After treatment the meat was immersed in 75 ml. of distilled water in a blender for 3 min. and serial dilutions then plated out on to Difco agar pH 6-8, incubated at 23°C. for 48 hr. When testing oysters Clorpactin was added directly to their own liquor. Results showed that when using crabmeat, immersion in the concentration of *Clorpactin* required to achieve the required degree of disinfection caused a "chlorine" smell and a bitter taste to be imparted to the product and therefore no favourable recommendations could be made. Under the test condition used the author inferred that bactericidal conditions were obtained in the oyster experiments when a concentration of 0.56% Clorpactin was used. He concludes that even though Clorpactin does not appear, by virtue of this study, to be a "remarkable" bactericide for food, it does offer a means of reducing the bacterial flora of oysters to within legal tolerances.

Sonic disruption of azotobacter

During the sonic treatment of suspensions of Azotobacter vinelandii the direct count and turbidity decrease exponentially. The total and viable counts decrease at the same rate which indicates that the chief mechanism of killing is disruption of the cell. Turbidity

decreases only 40% as rapidly as the decrease in total count.

The turbidity in excess of that contributed by residual intact cells results from the scattering of light by large fragments of the broken cells. These fragments, which have been designated as "hulls," are empty but retain the shape and rigidity of the cell. Turbidity appears to be a function of the cell envelope and is independent of the rupture of the cell.

A "hit" on an intact cell disintegrates approximately 40% of the surface to sub-microscopic particles and empties the residual hull of cytoplasmic contents. The rates of release of glucose-6-phosphate dehydrogenase and RNA are identical with the rate of rupture of the cells which indicates that these substances are present in the cytoplasm. The rate of release of hydrogenase, cytochrome and phospholipid coincides with the decrease in turbidity which suggests that these substances are

Sugars as inhibitors

present in the cell envelope.

Glycerin, levulose, dextrose, sorbitol, sucrose and invert sugar are widely used by the pharmaceutical, cosmetic and confectionery Sugars and polyols industries. are good nutrients for microorganisms and spoilage of preparations containing them is a problem. Therefore, a study has been made of their inhibitory action on common spoilage microbes.10 Glycerin, levulose, dextrose, sorbitol, sucrose, invert sugars and various mixtures of these substances were studied, using Staph. aureus, Ps. æruginosa, P. notatum, Asp. niger and M. Albicans. 5% and 10% solutions at pH 5.6 were used. These were autoclaved and then inoculated with 0.1 ml. beef heart infusion suspensions of the various test organisms. Incubation was at 37°C. up to 30 days.

Overall, glycerin appeared to be the most active inhibitor, 40% solutions preventing growth of all test organisms. After this in descending order came levulose, dextrose, sorbitol, sucrose and invert sugar. It appeared from these results that the higher the mol. wt. the less the inhibitory action, and that this effect was largely one of osmosis. The tests showed that 65% sucrose w/w inhibits mould growth, but after standing for more than 30 days

moulds did grow on solutions of this strength. Hence it is believed impossible to inhibit moulds in sycrose solutions left unpreserved for a long time, unless they are produced under aseptic conditions.

A study of Warexin

Warexin is the trade name of a formulation containing a group of hypochlorous acid compounds. In the U.S., reports have appeared on the efficacy of such antibacterials in the treatment of tuberculous cystitis, as a surgical antiseptic, as a tuberculocide and as a topical germicide in otolaryngology. Some laboratory tests relative to such uses have now been made.11 The test organisms were Cl. welchii, Cl. sporogenes, two unidentified erobic bacilli, Prot. vulgaris, Ps. æruginosa, Sh. dysenteriæ, M. tuberculosum (H37 Rv.), C. albicans and Coccidioides immitis. Each of these organisms was grown conventionally and inocula prepared containing 105 bacteria or spores. Two test procedures were used. One involved the use of a Millipore membrane filter which was attached above to the barrel of a syringe and below to a cannula. cannula was carried through a rubber bung which fitted into a vacuum flask. The organism suspensions were mixed with varying strengths of the disinfectant and after suitable contact times (1, 5, 10, 15 and 30 min.) at 22°C., 5 ml. of the mixture was removed and pipetted into the sterile syringe barrel. Vacuum was applied and 4.5 ml. of this mixture was sucked into the flask, leaving any viable organisms deposited on the filter. The filter was removed aseptically, planted into suitable media and held at optimum growth temperatures for 30 days, or, in the case of T.B., for 60 days. The second test method was done with surgical silk loops impregnated with bacterial spores, which resist constant boiling HCl for 5 min. (U.S.D.A.).

The pH of the Warexin solutions was between 6.75 and 7.28 and by the test methods described was more antibacterial than corresponding strength Carrel-Dakin solutions. Repeat tests using Carrel-Dakin solutions at a similar pH showed parallel results. Tests were also made with the addition of 5% bovine serum and these showed lowered antibacterial activity of Warexin. Sporicidal tests

(Concluded on page 485)

Cosmetic Society's Aerosol Symposium

THREE aspects of aerosols in the cosmetic and perfumery industry were considered at a symposium held by the Society of Cosmetic Chemists in London on October 14.

Mr. K. Dixon, B.SC., of Cooper, McDougall and Robertson Ltd., outlined a method for recording aerosol spray patterns, Mr. A. Herzka, B.SC., A.R.I.C., of the Metal Box Co. Ltd., discussed compressed gases as propellants for cosmetic products, and Mr. J. Pickthall, F.R.I.C., of Polak and Schwarz Ltd., discussed perfumes in pressurised products. Here are abstracts of these three papers.

Recording aerosol spray patterns

The type of spray required for inhalation therapy varies from particle sizes of the order of 5 microns, through insecticide sprays with an optimum particle size of 50/20 microns to residual deposits where a coarse spray or even a jet may be required. A subjective record of the type of performance obtained from a given example may be had by simply observing the spray. It is nonetheless desirable that a permanent record should be obtained during formulation work.

The apparatus demonstrated gave a record of the pattern of the spray and also an indication of the particle size. The basis of the method is as follows: A very soft coating of magnesium oxide may be given to a glass plate by burning magnesium beneath it. The plate is then opaque and the coating is sufficiently soft to be disrupted by small droplets of liquid, thus when the plate has been sprayed and is viewed against a strong light a pattern of holes is seen which corresponds to the position and size of individual droplets. To stop an excessive quantity of spray reaching the plate and spoiling the pattern, it is necessary to employ a shutter device.

Although the coating is extremely soft, if it is carefully handled the plates may be placed downward on photographic printing paper and prints taken of the patterns, thus giving a permanent record.

Compressed gases as propellants

Within the last year, interest in the use of compressed gases as propellants has been rekindled to such an extent that pressurised packs utilising such propellants are already widely sold in the United States of America. The marketing of such packs cannot be long delayed in Great Britain.

When using compressed gases with cosmetic (and other) viscous products it is possible to disperse the products in non-aerated form. This method of packing has already been applied in the U.S.A. to toothpaste and is of course equally suitable for other cosmetic products, such as shampoo and hair cream.

It is, however, important to remember that the pressure within the dispenser drops progressively as the product is dispensed and a stage will be reached when the pressure is insufficient to expel the remainder of the contents.

An essential requirement of packs of this nature are valves suitable for dispensing viscous products.

Liquid products may also be dispensed with compressed gases, although the drop in pressure will have a definite effect on the resultant spray characteristics.

Formulation for packs pressurised in this manner must be as thorough as with the more conventional packs. Although on first thoughts the filling procedure would appear to be a very simple one it must be associated with very stringent quality control to ensure the success of the product.

Perfumes in pressurised products

A traditional handkerchief perfume is simply an alcoholic solution of odorous ingredients; its pressurepacked equivalent also exists in this form together with a liquefied propellant, usually of the halogenated type.

Blending. Two chemicals of similar vapour pressure may produce either one single odour impression or the two items may retain distinct and separate odours. This depends upon their affinity for one another. The ultimate aim in perfumery is to harmonise many separate odours into one blend and this is achieved by making use of the physical attraction which some molecules have for other molecules. Hydrogen-bonding, dipole Waals attractions and van den forces can be considered. As the molecules of the mixture leave the solution, they become separated in varying degrees. Conditions of dispensing the solution obviously affect the ultimate odour as the nose receives it.

Ageing. The odour of a perfume changes with age. These are chemical reactions and interactions which occur between the various chemicals which include alcohols, esters, aldehydes, acids, acetals, ketones, ethers, phenols, amines, etc.

We can consider three types of sprays:

- 1. Wet sprays of genuine colognes.
- 2. Medium wet sprays of sophisticated colognes.
- 3. Dry sprays for true handerchief perfumes.

Spray characteristics are determined by the composition of the propellant, the ratio of alcohol to propellant, by the water content and finally, by the type of valve employed. The amounts of perfume to use are discussed with special reference to the low amounts said to be required in aerosols when compared with non-pressurised types.

Drastic changes in odour are said to occur when a perfume is pressurised. In terms of immediate effects, this is only true when the solution is space sprayed. When sprayed on to a surface, there is little or no difference in odour between a pressure-packed perfume and a conventional type. spraying results in a drenching of the receptors and the balance of odour may be completely upset. Certain chemicals leap into pro-minence while others lose their normal intensity. Irritation effects are also magnified under spacespray conditions.

The stability of a perfume packed under pressure depends upon many factors. Under the most favourable conditions the amount of deterioration may not be serious. favourable conditions would be glass, low water content, complete absence of metallic impurities and the use of dichlorotetrafluoroethane. If the conditions of packaging are not completely favourable, then perfume deterioration can Traces of hydrochloric serious. acid (the result of hydrolysis of the propellant) can play havoc with a perfume, and metallic impurities can catalyse unwanted reactions.

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LH/EW/XMAS

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November 1958.

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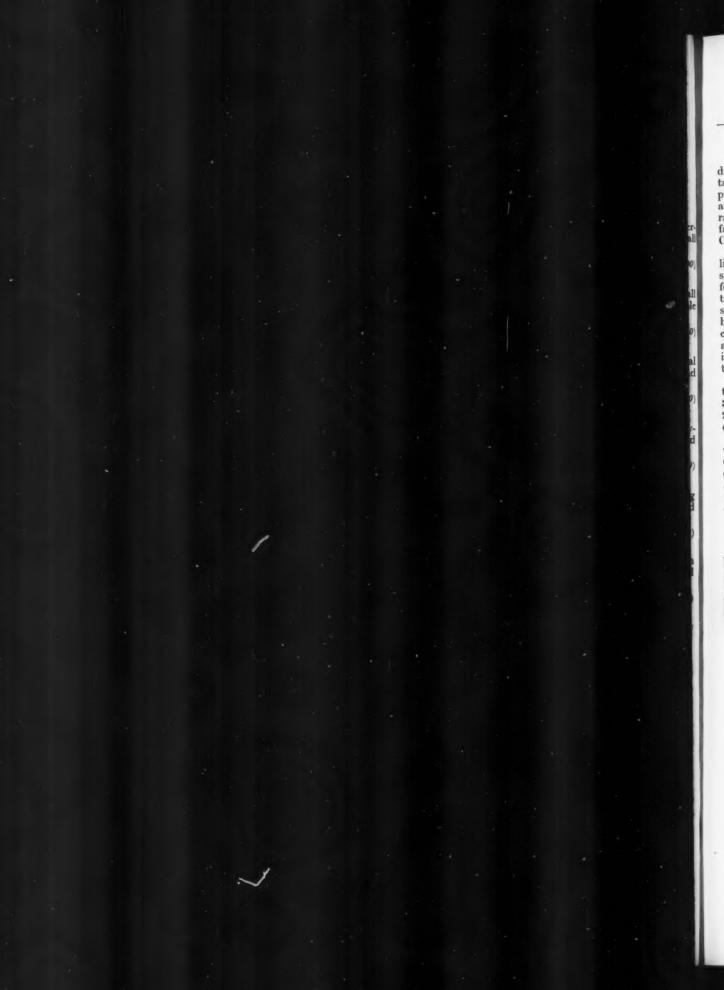
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PLANT AND EQUIPMENT

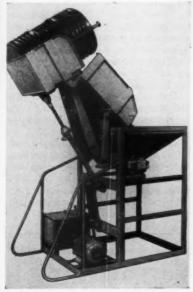
Lifting and Discharging

To accelerate the discharging of drums into hoppers or other containers and to relieve staff from physical strain, a drum or sack lifter and discharger has been added to the range of *Mackaness* loaders manufactured by the Service Engineering Co. (Northampton) Ltd.

It is claimed that this unit will lift and tip drums and sacks at the speed of 10 sec. for lifting and 4 sec. for tipping. It can be supplied to lift to heights of 4, 5, 6 or 7 ft. (or special heights to order) and has been designed to be positioned close to equipment into which goods are to be discharged. If desired it can be permanently secured to this equipment.

Lifting capacity is 5 cwt. and the power unit is a 400/440 volt, 3 phase, totally enclosed fan cooled 2½ h.p. electric motor, with direct coupled hydraulic pump.

The unit measures 6 ft. by 3 ft. wide and offers approximately 9 ft. 6 in. headroom. These dimensions can be altered to suit various applications. As an alternative, the whole machine can be mounted on wheels or rails for loading any number of hoppers in close proximity to each other.



The self-contained model of the drum or sack lifter; this can be positioned as required. Lifting capacity is 5 cwt.

Gum Conditioning and Dispensing Machines

The Mixamatic gum conditioning and dispensing machine has been designed by the Purdy Machinery Co. Ltd. to provide a means of conditioning gum, without additives, to its ideal state and to dispense it in that state wherever required on instant notice.

The dispensing nozzle with its built-in switch, controls the driving motor, has an instant cut-off and is so designed that the nozzle itself works from 13 volts only, thus eliminating all fear of shock or harm to the operator.

All contact parts are in noncorrodible material, and the machine



The gum conditioning and dispensing machine topping up the gum box of an automatic labeller.

is said to be self cleaning and capable of handling most types of adhesive. The tank, which has a 5 gallon capacity, is made in stainless steel, whilst the electric motor is ½ h.p., drip proof and is available for all standard voltages. The pump is of monobloc construction, is self priming and has an approximate capacity of 48 g.p.h. The casing, cover and impellor are in gunmetal and a stainless steel plate seals the motor shaft from liquid. The rotor and motor drive shaft are also in stainless steel.

The dry weight of the *Mixamatic* is 128 lb. and its dimensions are: 3 ft. 4 in. by 2 ft. 6 in. by 2 ft.



MIC/VAR Semi-Micromantle for spherical or pear-shaped flasks from 10 to 25 c.c. capacity. It can heat liquids to 240°C. in 6 minutes.

Electronic Heater for Semi-micro Chemistry

An accurately controllable source of heat is provided by a new electric surface heating unit, known as the MIC/VAR semi-micromantle, made by Isopad Ltd. It supplements the range of micromantles already available for flasks from 5 to 50 c.c. capacity. The unit incorporates a temperature control and has been designed in co-operation with Mr. M. A. Fill, F.R.I.C., senior lecturer in chemistry at the Norwood Technical College, and Dr. J. T. Stock, associate professor in chemistry, University of Connecticut, U.S.A.

The semi-micromantle can accommodate spherical and pear-shaped flasks from 10 to 25 c.c. capacity. The flasks are cradied in a pliable heating surface made of glass fibre yarn interwoven with insulated electric resistance wire. The grey stove-enamelled metal casing protecting the heater incorporates a variable resistor for the stepless adjustment of the operating temperature. It also has provision for mounting a supporting rod to which top-heavy glass assemblies can be clamped.

The unit has a consumption of

30 W from a 200/250 V A.C. or D.C. supply and weighs less than 31 lb.; it measures 8 in. × 41 in. × 31 in. high. The temperature range is from ambient up to 270°C. and is steplessly variable. It is reported that the pliable heating surface ensures such a high rate of heat transfer that a liquid temperature of 240°C, can be attained in 6 min. Unlike open flames, this heater is not affected by draughts, nor do liquids spilled on it cause damage.

Powder Blending

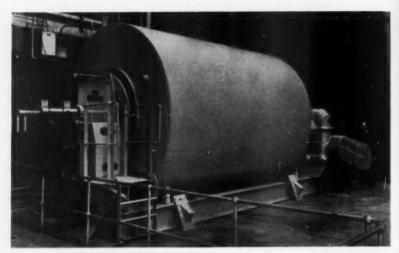
Designed to obtain a homogeneous blend of very fine polymer powders, what is stated to be one of the largest powder blending machines ever to be made in the United Kingdom has been designed and manufactured by the Sturtevant Engineering Co. Ltd.

The unit is approximately 25 ft. long overall, 13 ft. high and 12 ft. wide. It has an uncharged weight of approximately 17 tons, and is capable of blending single batches of up to 450 cu. ft. in volume. The shell and all material contact surfaces are lined in corrosion-resistant material, and the entire machine is arranged for internal purging with inert gas. The intake and discharge box forms a unit at one end of the machine, the charging and discharging mechanism being motorised for remote control.

The efficient action of the unit is obtained by both a cascade and lateral movement of the material, the lateral distribution being obtained by pivoted chute plates fitted with differential linkages.



Complete logger unit and mobile printer, one of the units of the data handling system for the Capenhurst uranium diffusion plant. The system will monitor 2,000 vital points in the plant giving continuous operating data.



The shell and all material contact surfaces of this powder blender are lined in corrosion-resistant material. The machine is capable of blending single batches of up to 450 cu. ft. in volume.

Versatile Spectrometer

An important feature of the wavelength spectrometer is its versatility. It is particularly useful where questions of cost have to be considered, as it is cheaper to use one instrument with several applications than to buy a separate

instrument for each application.

Hilger and Watts' wavelength
spectrometer can be used for qualitative and quantitative spectrochemical analysis; absorption spectrophotometry; monochromatic radiation in the ultra-violet; spectrophotometry in the infra-red; and Raman spectrography. It can also be used for studying the structure of line spectra; for interferometry for studying hyperfine structure, and for measurement of wavelength.

Data Handling Equipment

Sunvic Controls Ltd. have completed the first units for the data handling system they are supplying for the U.K.A.E.A. uranium diffusion plant at Capenhurst. It is believed that this will be the largest data handling system in Europe, consisting of eight units and two mobile printers plus control room and equipment. It will continuously and automatically scan more than 2,000 points at which are measured the temperatures of the uranium hexafluoride, glands, pump motor bearings, cooling water temperatures as well as motor currents and voltages.

Each unit contains more than 3,000 interconnections, over 450 relays and several miles of wiring. Over 6 miles of cable will connect the equipment to the plant.

Unit-Constructed Work Table

A unit-constructed work table has been designed by Farrow and Jackson Ltd. for general industrial Made with square tube legs that have a slight radius on the edges and with a hammer finish paint, it is both strong and easy to clean, there being a minimum number of dust traps. The tops are available in a variety of materials. Tops for the food and pharma-ceutical industries can be linoleum or plastic 3 in. thick, thus conforming to hygienic requirements.

Basic units consist of top, end leg and centre leg sections, bracing bars, screws and bolts, which are supplied in any combination required. They may be bolted together, end to end, or side by side, to form any working area necessary, each individual unit being 2 ft. 9 in. square by 2 ft. 9 in.

Adjustable feet are fitted to allow for inequalities in the floor.

> For more information about the plant and equipment described, please use the coupon on page 498

BOOK REVIEWS

Neomycin

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Its Nature and Practical Applications. Edited by S. A. Waksman, Baillière, Tindall and Cox. London 1958. Pp. x + 412. 40s. net.

THE title-page of this book appropriately bears the imprint of the Institute of Microbiology, Rutgers University, with its diagrammatic illustration of Streptomyces—that cornucopia of antibiotics.

The symposium, by 35 contributors, is edited by Prof. Waksman, who with H. A. Lechevalier first recorded neomycin in 1949. Hopes were then high, as the new antibiotic had a wide spectrum, and appeared to possess many of the advantages of streptomycin without its defects. Later it was found that when administered parenterally neomycin was liable to cause per-manent deafness and to exert adverse effects on the kidney. The main uses of neomycin at present appear to be as an intestinal antiseptic and for external applica-

Nine years is not long in which to explore all the possibilities of an antibiotic; but the present volume gives an impressive account of the progress of neornycin to date. Section I deals with matters concerning various strains of the neomycin organism. Streptomyces fradiæ; the chemical and physical properties of neomycin; and its production and purification. Published work on large-scale industrial production is very meagre, and most of the data quoted in this book refer to small-scale studies. The chapter dealing with microbiological and chemical methods of assay is particularly useful. Assay is complicated by the fact that different samples may contain varying proportions of the components neomycin B, neomycin C, and their breakdown product neamine, and that these do not give the same response.

Section II covers antibacterial and pharmacological properties of neomycin, and Section III its clinical uses. Section IV deals with miscellaneous uses and possibilities, e.g. in veterinary medicine, in animal nutrition, and in phytopathology.

Appendices include a Bibliography of 691 references, a tabular summary of clinical uses, a list of manufacturers in America and elsewhere, and a complete list of commercial preparations which contain neomycin.

L. D. GALLOWAY.

Organic Syntheses

Edited by J. Casson. Vol. 37. Chapman and Hall. Pp. vii+109. 32s. net.

This volume describes the preparation of 29 organic chemicals and contains a cumulative index covering volumes 30-37 in this series.

The established format for reporting these preparations is maintained and each synthesis has been checked by independent workers.

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Modern Chemical Processes

Vol. 5 Reinhold. (Chapman and Hall). Pp. 154 inc. index. Illustrated. This book provides the reader with 14 articles in the well-known staffindustry collaborative series of Industrial and Engineering Chemistry. They are all first-class examples of technical journalism at its best, since they combine the authority of experts with the professional polish of the experienced technical writer. Industry is not particularly keen on disclosing technical information and the editors of I. & E.C. are to be congratulated on the way they have charmed their victims into releasing data which are of permanent value to the literature.

Like every other volume in the series, this one covers a remarkable range of chemical processing-from uranium to lard. All but one of the articles describe American plants and processes. The exception is a description of the manufacture of sulphuric acid from anhydrite at Marchon Products Ltd., in Cumberland. Frank Schon, managing director of Marchon, and Hans Zirngibl of Farbenfabriken Bayer (whose process is used) collaborated with W. Q. Hull on this article.

This fifth volume of an excellent series enhances the reputation of I. & E. C. and deserves a wide readership.

W. G. N.

DISINFECTANTS

(Continued from page 481)

indicated that 1.25% Warexin was ineffective after a 2 hr. exposure time. Tests on vegetative organisms showed that 0.1% Warexin is highly bactercidal, but the addition of protein, and storage above 70°F., affected it. The active antibacterial principle appears to be Clorpactin. This is corrosive, the authors claim, for the fine "stainless" steel used for surgical instruments.

The modification of Portner's technique, using the Millipore filter as described in this paper, is ingenious and might usefully be more broadly applied. The authors give no indication of any previous knowledge of evaluating "chlorine" based sterilisers, nor of any experience in practice—which is a pity, since they are bold enough to hazard an opinion regarding use in hospitals and operating-rooms. This is a trap so many fall into. Laboratory

experience is one thing, experience in practice is so often very different. However, the work as a laboratory essay is interesting and worthy of study.

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NOTES AND NOTIONS

TEMPLES OF HEALTH

THOSE who want the Government to discourage people from smoking should take a look at the latest Treasury poster which gives a simple breakdown of Budget revenue and expenditure. It shows clearly the Government's dilemma. Tobacco is the third biggest single revenue raiser. It provides 2s. 9d. of every pound collected. This is more than half as much as is spent on defence and a good deal more than is spent on Health. With alcohol duties, tobacco raises 4s. 4d. of every pound received by the Exchequer. Health and Education expenditure together amount to 3s. 10d. in every pound. So if we became a nation of abstainers the only way we could maintain our hospitals and schools would be by paying even more income tax. In a financial sense the breweries are the patrons of learning and the tobacco factories the temples of health.

"WHAT IS THE MEANING OF MY JOB?"

Many people work in factories that make products of such a highly technical nature that their industrial significance must baffle the average worker. An interesting attempt to explain their products to their workpeople has been made by British Oxygen Gases Ltd. The idea arose when it was reported that a number of employees had asked for background information on the work they were doing. A typical question was "What happens to this product when it leaves us; who else helps in its manufacture and what exactly do they do?" The management accordingly arranged a series of lectures by senior people from each department to explain how industrial gases are made, how they and other industrial and medical products are sold, how they are delivered, and the system of payment used.

It was thought that if ten people attended it would justify the lectures. In fact between 30 and 40 came and the scheduled half-hour question period frequently exceeded an hour. The experiment was so successful that more lectures are planned.

It is certainly encouraging to

learn that many workpeople are sufficiently interested in the broader aspects of their job to give up some of their leisure to learn about them. The idea seems psychologically sound, for surely everyone likes to think that what he is doing is important. The old rhyme, "For the sake of a nail a shoe was lost, for the sake of a shoe a horse was lost, for the sake of a horse a rider was lost, for the sake of a rider a battle was lost" might have been written to encourage military blacksmiths to take extra care.

DYED GRASS

THE abnormal and depressing rainfall which marred the summer months has ensured that England remains a green if not entirely pleasant land. The rain may have rotted flowers and vegetables and encouraged mildew, but at least the lawns have flourished. So it is safe to say that here there would be no hope at all for a new product which has been marketed in the U.S.; it is a dye for restoring greenness to lawns that have turned brown through heat and lack of rain. Good green effects have been achieved on lawns for periods varying from a fortnight to six weeks. Occasional watering is recommended, partly to prevent too much of the colour from being rubbed off.

Is there a case for the development of a chlorophyll-containing lawn dye? Would it improve the smell as well as the tint of grass?

SPIDERS AND GLASS

I THOUGHT that the "scientific" use of spiders went out with alchemy, but apparently they are now in the scientific instrument business. To measure the stress in toughened glass an instrument called the Babinet Compensator is used. It needs a scale with a dividing line as thin as—well, a spider web. So, the Triplex Co. tell me, they use a spider web.

When a new web is needed the designer-mechanic at the Triplex laboratory pops down to the cellars. Old webs are unsuitable because of dust. So he has to find a spider and persuade it to eject a brand-new web. How he does this is not revealed. It is probably a trade secret of the glass industry.

ROLLS WITH HOLES

It is fashionable to celebrate all kinds of anniversaries these days, so I was not very surprised to be told by the British Patent Perforated Paper Co. Ltd. that the modern toilet roll is 75 years old this year. In a world of change this indispensable accessory of the smallest room in the house has remained the same. "The thin, strong manilla tissues, made world famous in more recent vears under the trade name of Bronco, are the same as those of the early days, originally known as British No. 1 Thin," says the company. It all started in Albany, New York, in 1883 when a Mr. Seth Wheeler, who had invented machinery for the perforation of paper, made an agreement with a Mr. James Lawson enabling him to start a toilet tissue business in Britain

This reminds me of the story of the man who recommended the drilling of holes in aircraft wings to prevent them breaking under strain. He said he got the idea from the toilet roll. It never tears off where it is perforated, he claimed.

AGE OF EUPHEMISM

LORD MANCROFT, who has a reputation as a witty after-dinner speaker, gave good value at the annual dinner of the Association of British Chemical Manufacturers last month. Explaining that his Government post was Minister without Portfolio, he said the title was a euphemism for "Government Dogsbody." He represented all kinds of Ministries in the House of Lords, a job that might seem surprising to the public but not half as surprising as it seemed to the Ministries concerned.

He illustrated the contemporary partiality for euphemism with examples like "rodent operator" (rat catcher), "feline alimentation ispenser" (cats' meat man), noctician" (night watchman) and dispenser " so on. Sanitary engineers now have the sanction of Parliment to call themselves "Public Health Officers." We can consider ourselves lucky, commented Lord Mancroft, that they did not go further and demand called Privy to be Councillors.

Cicerone

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Plant delivery dates must be "sacred"

B.C.P.M.A. Chairman urges square deal at annual dinner

Delivery dates and the need to honour them was the theme of the two speeches at the annual dinner of the British Chemical Plant Manufacturers Association held in London on October 29. The chairman of the association, Mr. H. W. Fender, told the record turn-out of over 700 members and their guests that it was time that both sides—customer and manufacturer—gave each other a square deal. Customers should not ask for delivery before plant was actually needed and should ensure that the plant manufacturer was not held up by delay in finalising designs. The plant manufacturer, for his part, should strictly honour a delivery date thus arrived at. "In the Association," continued Mr. Fender, "we see both sides of the problem because a number of us are plant contractors as well as plant manufacturers."

Replying to Mr. Fender, the chief guest of the evening, Sir Miles Thomas, chairman of Monsanto Chemicals Ltd., recalled his experience in B.O.A.C. and instanced the success of the Comet IV aircraft as an example of the importance of honouring delivery dates. But the chemical industry was even more inportant than the aircraft industry, chemical exports at £250 million a year being more than double the value of aircraft exports. Now overseas competition was stiffening and chemical manufacturers had to make decisions the success of which depended absolutely on new plant being delivered on time and starting up on time. "Delivery dates must be sacrosanct," declared Sir Miles. The British chemical industry had spent £600 million on new plant since the war. Its continued ability to buy depended to a large measure on getting the right plant at the right time. He asked the industry to show the "spirit of the Comet" in honouring its commitments.

Earlier in his speech Mr. Fender referred to arrangements made between the U.K. Atomic Energy Authority and the Association whereby plant manufacturers were to be allowed to use technical information supplied by the authority for overseas contracts. He wanted more co-operation of this kind because overseas countries wanted to develop their own chemical industries. "They are going to get the know-how from somewhere. Then let it be British know-how and British plant. Let us in this way retain a long-term continuing interest in these markets for the British chemical and chemical plant industries. Otherwise we may lose them altogether."

British Hydrocarbon Chemicals will double output

Capacity for the production of olefins for the manufacture of petroleum chemicals by British Hydrocarbon Chemicals Ltd. will be more than doubled by the installation of a third ethylene plant at Grangemouth, due to be completed by the middle of 1960.

The Secretary of State for Scotland, the Rt. Hon. John Maclay, inaugurated this latest expansion at Grangemouth by driving the first pile of the new project on October 17.

Production of ethylene and other olefins commenced in 1951, and was expanded in 1956 with the completion of a second unit. The third plant will have a capacity greater than that of the first and second units combined. It will be the largest plant of its kind outside the U.S.A. and will be considerably bigger than any other such plant so far planned in Europe.

The additional ethylene produced will enable existing ethylene utilisation plants, and the *Rigidex* polyethylene plant now under construction to be operated at full capacity. Sufficient ethylene and other olefins will also become available to enable a

further programme of development to be undertaken.

With the completion of the project and of the polyethylene and phenol plants now under construction, the total investment by British Hydrocarbon Chemicals Ltd. (which was formed in 1947) will amount to over \$30 million.

Cough medicine addiction

Cough mixtures often contain opiates which are dangerous because they may lead to drug addiction, according to the Expert Committee on Addiction-Producing Drugs of the World Health Organisation, which met in Geneva last month. The experts pointed out that non-addicting cough medicines have been developed which are equally efficient and may help reduce the incidence of drug addiction.

Other points on the Committee's agenda were: clinical methods for measuring tolerance and physical dependance, international non-proprietary names and unification of chemical nomenclature for narcotic drugs.

British chemist gets Nobel Prize

Dr. F. Sanger of Cambridge has been awarded the Nobel Prize for chemistry for his work on the elucidation of the structure of insulin.

Dr. Sanger's method for determining the structure of insulin has set a new standard for organic chemists in the level of complexity in structure that can be reduced to order and set down as a formula, and his method will undoubtedly enable the structures of many more proteins to be worked out.

Prescribing changes after ten years of N.H.S.

The change-over from traditional mixtures to factory-prepared and packed tablets and similar products during the ten years of the Health Service has altered but not diminished the pharmacist's responsibilities. This was said by the Minister of Health, Mr. Walker-Smith, when he addressed the Executive Councils' Association at Torquay an October 24.

In 1948 traditional mixtures accounted for 33.3% of the total of N.H.S. medicines and tablets and similar products for 29.2%. In 1957 the respective percentages were 18

Biggest-ever corrosion show

Britain's biggest-ever display of anticorrosion methods and materials will be staged in London next April. It will be the 1959 Corrosion Exhibition in the Royal Horticultural Society's New Hall, Westminster.

For four days from April 27, 69 exhibitors will show and demonstrate all that is new in the battle against corrosion, the menace which presents Britain with a £600 million bill each year. The first Corrosion Exhibition was held in October 1957. Encouraged by the success of this three-day show—which attracted 8,000 visitors—the organisers, the technical journal Corrosion Technology, planned an even better show.

Nearly 20,000 sq. ft. of floor space will be used to show a complete range of anti-corrosion products including:

Anti-corrosion Fluids; Cathodic Protection; Cements; Coatings and Linings; Conduits; Corrosion Prevention Tapes; Corrosion-resistant Metals; De-rusting tools; Epoxy Resins; Finishing Processes; Fuel Additives; Galvanising; Industrial Glassware; Industrial Porcelain; Metal Finishing; Metal Spraying; Non-Ferrous Metals; Paints; Plastics; Rubbers; Valves; Water Treatment.

All enquiries about the 1959 Corrosion Exhibition can be answered by The Exhibition Organiser, Corrosion Technology, Leonard Hill House, Eden Street, London, N.W.1. Telephone Euston 5911.

Chemicals in the Free Trade Area

Problems discussed by A.B.C.M. chairman at Annual Dinner

In his speech at the annual dinner in London on October 8, Mr. Bernard Hickson, chairman of the Association of British Chemical Manufacturers, discussed some of the behind-the-scenes problems of the negotiations for the European Free Trade Area. The British chemical industry has given its full support to the FTA, subject to safeguards on dumping, trade marks, subsidies, quotas and patents. In discussing the matter with other European chemical associations, a major controversy had arisen over the definition of origin of chemicals, so as to ensure that sufficient processing and work are performed in the Area before the resulting products could be considered of Free Trade Area origin. The French and Italians thought that it was impossible to prepare a formula to cover chemicals which would be workable by the Customs Authorities of all the countries concerned, without leaving a loophole for entry into the FTA of a flood of cheap chemicals from outside, to which little processing and increased value had been added inside the Area.

The special A.B.C.M. committee devoted weeks to detailed work on this point. As a result, a scheme for the definition of origin of chemicals by process criteria has been approved by the Association and accepted by the Board of Trade and Customs Departments. This now forms the basis for negotiation in O.E.E.C. in Paris.

Unofficially it was also known that the chemical manufacturers associations of the Scandinavian countries, Austria and Switzerland approved this plan and, in addition, it had been received with sympathy and understanding in the other countries of the Common Market.

Basic research. Although many of the Association's members were carrying out their own individual work, it was known that there were many basic common problems which could better be handled by a co-operative scheme in conjunction with the universities. Accordingly, said Mr. Hickson, the Association had enlisted the co-operation and advice of the departments of chemical engineering in nine universities.

The committee had long-term work under discussion with a group of university professors and it was hoped that this would result in useful information for the industry. A byproduct of this scheme would undoubtedly be closer consultation between the universities and industry on educational planning and also the valuable experience on planned research which would be gained by young graduates engaged on this work.

Regional organisation, Speaking at the annual general meeting of the Association on October 9, Mr. Hickson stated that the establishment of a Regional Organisation had been a The attendance of great success. the regional chairmen at council meetings had added vitality to dis-The new move to give cussions. regional chairmen full voting status as members of council would bring valued additional representation from members in the provinces. In return the Association had established a channel of approach to members throughout the country for the dissemination of information which was formerly lacking.

Chemical engineering. Mr. Hickson went on to say that the chemical engineering research committee working in conjunction with the corresponding committee of the B.C.P.M.A. had made a start with the programme of co-operative research in chemical engineering. In considering how this, the first of a number of joint research projects, should be financed the Council had decided that new activities of this kind, when considered to be in the interest of the majority of members, should be financed direct from Association funds instead of by a constant series of appeals to individual members.

Restriction on sale of medicines declared void

The president of the Restrictive Practices Court announced on October 13 that the Court was not satisfied that the restrictions in the Chemists Federation constitution and rules under which members of the federation are obliged to confine the distribution of C.F. products to retail pharmacists can be justified under the provisions of Section 21 of the Restrictive Trade Practices Act 1956.

An official statement on this decision will be issued by the Federation in due course; in the meantime manufacturer and wholesaler members have been informed that no order of the Court will in any way affect their rights as individuals to sell or not to sell their products according to their own trading policy.

Pfizer buy Kemball, Bishop for £2.9m.

Pfizer Ltd. has purchased for £2,900,000 virtually all the shares of Kemball, Bishop and Co. Ltd., except for about 17% already owned by Chas. Pfizer and Co. Inc., New York.

Kemball, Bishop and Co. Ltd. is a private company founded in 1870. It manufactures a range of fine chemicals used principally in the pharmaceutical, food and beverage industries. The products include tartaric acid and its salts, citric acid and its salts, gluconic acid and its salts, ittaconic acid, kojic acid and various others. The products have an expanding sale in Britain and abroad. The staff of Kemball, Bishop numbers about 650.

In 1935 the company was granted a licence by Chas. Pfizer and Co. Inc. for the manufacture of citric acid by fermentation processes and, at the same time, Chas. Pfizer and Co. Inc. became a shareholder.

Pfizer Ltd., British subsidiary of Chas. Pfizer and Co. Inc., has substantial chemical manufacturing facilities at Sandwich, Kent, and the acquisition of Kemball, Bishop will create a group with a strong manufacturing position in the fine chemicals field.

The executive directors of Kemball, Bishop, namely Mr. W. W. Muir and Mr. R. F. Kemball, joint managing directors, together with Mr. F. G. Hart, finance director, will continue on the board and in their existing posts.

Mr. Richard C. Fenton, chairman of Pfizer Ltd., has been elected a director and chairman of Kemball, Bishop. Mr. P. V. Colebrooke and Mr. B. Page, respectively managing director and director (controller) of Pfizer Ltd., have also been elected directors.

The intention of Pfizer Ltd. is that Kemball, Bishop will continue as a separate entity, handling the group's bulk fine chemicals.

OUTLOOK FOR CHEMICALS IN EUROPE

The Chemical Products Committee of the O.E.E.C. has met under the chairmanship of Mr. de Schrijver (Belgium) and drawn up a report on the situation of the chemical industry in Europe in 1957 and the first six months of 1958.

After its slightly slower rate of expansion in 1956, chemical production in member countries increased by 10% in 1957, whereas total industrial production increased by 5%. For the whole of 1958, chemical production

will again increase, but most probably more slowly than in 1957. Investment in the chemical industry in 1957 is estimated to have been \$1,000 million, which is some 7% above the 1956 figure.

Trade in chemical products is still growing rapidly, especially exports to non-member countries.

Among other points, the Committee discussed the study to be made of technical and administrative regulations for pharmaceutical products. Mr. Richard Turner has been appointed a managing director of Johnson, Matthey and Co. Ltd.

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Mr. R. C. Agabeg has been appointed assistant sales manager of the Chemicals Division of Union Carbide Ltd.

Mr. C. R. B. Williamson has been appointed marketing director of Bayer Products Ltd. and Winthrop Products Ltd., and to the boards of directors of both companies.

At the autumn conference of the Association of British Pharmaceutical Industry, Mr. R. L. Taylor, managing director of Johnsons of Hendon Ltd., was presented with a gold cigarette lighter to mark the completion of 21 years' continuous service on the Council.

Mr. John Edgar Braham, who has been engineering controller of Imperial Chemical Industries Ltd. since 1950, has retired. His successor as I.C.I. engineering controller is Mr. Robert Hugh Dibb, who has been engineering director of I.C.I. Plastics Division since 1946.

Mr. R. W. Oxtoby, who has been manager of the Burma Pharmaceutical Industry in Rangoon since its inception, has returned to England and has been appointed director and general manager of Evans Medical (Services) Ltd.

Mr. W. E. Page, managing director of Bengue and Co. Ltd., who has now completed over 33 years' service with the company, will be leaving England at the end of this month for a tour of South Africa, the Rhodesias, Mozambique, Kenya, Tanganyika, etc., where he will be visiting the company's agents and representatives. He expects to be back in England by mid-March.

Mr. Jacques Leal has been appointed managing director of Bourjois Ltd., soap and perfumery manufacturers, in succession to Mr. G. R. English, who has retired for health reasons. Canadian citizen, Mr. Leal, who is 48, was born in London and has lived in Britain for a number of years. He was educated in France, has travelled widely and has had world-wide business interests for many years. He started his career in the perfumery and cosmetic industry at the age of 19 and he has since acquired specialised knowledge of merchandising, packaging and advertising. Mr. English, who had been with the company for 31 years, was first elected to the board in 1947 and had been managing director for the last eight years. He had a special knowledge of the soap side of the business.





J. Leal

H. E. Cooper

Mr. H. E. Cooper has been appointed managing director of G. A. Harvey and Co. (London) Ltd. He was first appointed to the Board in 1946, and has been acting as deputy managing director since May of this year. Mr. I. A. Marriott succeeds Mr. P. T. Bliss as sales director. Mr. Bliss, who has been with the Company for 50 years, retires on December 31.

Mr. B. J. Page, secretary and controller, and Dr. K. L. Lynes, general works manager, have been appointed directors of Pfizer Ltd.

Mr. Page, who joined the company as Chief Accountant in 1954, was appointed company secretary and controller in January of this year. He qualified as a chartered accountant in 1937 and during war service from 1939-45 won the M.C. in Italy. Aged 42, he is married with three children and lives in Folkestone, Kent.

Dr. Lynes, who is a native of Coventry and lives at Sandwich Bay, Kent, graduated as a B.Sc. at Birmingham University in 1941 and took a Ph.D. in 1948. He joined the research and development department of the Distillers Co. and from 1949 to 1954 was in the fermentation department of Glaxo Laboratories. In 1954 he joined Pfizer as fermentation supervisor.

Mr. A. Alberman, founder and managing director of Innoxa (England) Ltd., and Scientific Pharmacals Ltd., left London by air on October 5 on a tour of several of his company's branches and agencies overseas. His itinerary will take him via East, Central and South Africa to the company's branch in Australia. On the way back he will visit his interests in New Zealand, Hong Kong, Singapore and Ceylon. He hopes to be back in London just before Christmas.

Dr. F. J. Green, technical director of Genatosan Ltd., and Mr. C. Collins, secretary of Genatosan Ltd., have been appointed directors of Loughborough Glass Co. Ltd. Mr. C. E. Macqueen has resigned from the board, as he has now assumed the position of general manager of Fisons Milk Products Ltd.

Mr. C. F. Huebner, chief buyer for British Oxygen Co. Ltd., has been elected president of the Purchasing Officers Association for 1958-59.

Cíba Laboratories Ltd. announce that Mr. J. G. Bedford, M.A. (OXON), B.SC., manager of their chemical factory at Pyewipe, Grimsby, has joined their board. He joined Ciba 12 years ago and has been responsible for the development of the Pyewipe factory since its inception. The factory makes sulphonamides and other fine chemicals; further extensions are in progress.

Mr. W. K. Warren, F.P.S., has been appointed by R. P. Scherer Ltd. as sales manager responsible for all marketing and sales activities in the U.K. and overseas. He served his apprenticeship with Condy U'Ren and Son of Plymouth, qualified in 1939 and was awarded an Associateship of the College of Technology, Birmingham. During the war he served as a navigator in Bomber Command and received the American Bronze Star. On rejoining his company, the British Drug Houses, he was subsequently appointed manager of their medical department. He is a past chairman of the Tunbridge Wells and District Branch of the Pharmaceutical Society.

Mr. Ivor Cooper of Unilever marketting division has been appointed advertising adviser to the Boards of Unilever Ltd. and Unilever N.V. The post is a new one and Mr. Cooper will combine it with his present duties as one of the heads of Unilever marketing division.

Mr. Cooper was the first chairman of Lintas Ltd., London, and played a major part in building up the international advertising organisation responsible for the advertising of Unilever products in most of the world markets.

Obituary

Mr. Gordon Pearce, Enamelled Metal Products Corporation's senior technical representative for the chemical industry, died suddenly in West Africa on October 6. He was on a sales tour of Africa, using a private aircraft for transport.

Mr. C. C. Mason, joint managing director of the Cambridge Instrument Co. Ltd., died suddenly on September 9, at the age of 77. He joined the company in 1910 and was joint managing director from that year until his retirement in 1941; he remained on the Board until his death. Mr. Mason was awarded an O.B.E. for his work on shell fuses in the first World War.

Tickopres Ltd.

After 15 years trading as Dapag, the firm has decided to be known by the name the public increasingly associates with the printing of labels, tickets and tags. Dapag (1943) Ltd. therefore is now known simply as Tickopres Ltd.

Joins Tobenoil Group

Auto Wrappers (Norwich) Ltd. have now joined Tobenoil Ltd., an industrial holding group. The new board of Auto Wrappers is: Mr. C. W. Maddison, managing director; Mr. C. F. Dennis, chairman; and Mr. J. P. Grimshaw, Mr. E. I. Hamilton-Parkes and Mr. T. Kenny, F.C.A., directors.

Cosmetic standards

The Toilet Preparations Federation are emphasising to members the value, as a protection for the entire industry, of the work of the Specification Standards Committee, and point out that this work cannot be fully successful without the active support and co-operation of all manufacturers. They therefore strongly urge all members when placing orders or making enquiries to quote the appropriate T.P.F. standard.

Slimming claims

The Periodical Proprietors Association standards committee has amended the paragraph relating to products, etc., advertised for slimming purposes in the 4th edition of the British Code of Advertising Standards. The amended paragraph states that no advertisement should offer any product or treatment for slimming, weight reduction or limitation, or figure control, if the taking or using of the product or following the course of treatment is likely to lead to harmful effects.

The alteration will result in substances and treatments for slimming purposes being dealt with on their merits and not according to a formula.

Benjamin jubilee

The Benjamin Electric Ltd., of Tottenham, London, celebrates its golden jubilee this year. The company was formed in London in 1908 to exploit the inventions of R. B. Benjamin, a well-known American inventor. The company has always specialised in industrial lighting and at its large factory it carries out the complete sequence of operations from the pressing of metal sheet to the testing of light fittings in such equipment as the photometric integrating sphere.

At a luncheon held to mark the jubilee, Mr. A. E. Iliffe, chairman of the company, replied to the toast "The Benjamin Electric" and Mr. H. G. Campbell, managing director, proposed the toast of "The Technical Press."

Technical Press Review-November

Chemical and Process Engineering.—Selection of Plant for Mixing Granular Solids; Pipes and Pipelines A Survey; The Changing Pattern of Gas Manufacture-2; Chemical Engineering for Shippingport Nuclear Reactor; Chlorine for Tetraethyl Lead Manufacture.

Corrosion Technology. - Lead Alloy Anodes; Lead Pigments in Corrosion-resisting Paints; Does Higher Fuel Efficiency Increase Corrosion? Steels for the Petroleum Industry-2: Prevention of Scale and Corrosion with Phosphates and Filming Amines.

Automation Progress. — Computers for the Business Man; Data Processing in a German Mail Order Firm; Digital Counting in Industry; A File Computer; Computers—A Means of Control; Picture Processing by Computer.

Petroleum. - Some Applications of High Nickel Alloys in the Petroleum Industry-1; Methacrylate Polymers as Oil Additives; Cardon Refinery; Free Hydrocarbon Radicals—2.

Paint Manufacture.—Aluminium Versatile Pigment-2; Guide to New Pigments; Properties Required of New Pigments; Importance of Pigment Particle Size; Nottingham High Polymer Conference.

Atomics.—Three Generations of Fission Reactors; The World Plan for Nuclear Power: Britain's Advanced Gas Cooled Reactor; Cutting the Cost of Heavy Water; Keeping Radiation Exposure Records.

Food Manufacture.—Fruit Freezing in the United States; The Protein Displacement Process; Some Observations on the Electrical Stunning of Pigs; The Problem of Improving Nutritive Value, with Special Reference to the Enrichment of Foods-5; The Swedish Sugar Industry.

Dairy Engineering. — The Production and Utilisation of Power and Heat in German Dairies; Practical Plant Cleaning Routines; Transport of Milk by Road; Italy's

Most Modern Dairy.
World Crops.—The Story of
Agricultural Chemicals; Gibberellic Acid; Control of Red Locust; Biological Control Using Ladybirds; Weed Control in the Tropics.

Heating mantles

The two process vessels heated by flameproof Isomantles which were illustrated on page 327 of our August issue are of 1,000 gal. capacity each and not 25 gal. as stated in the caption.

Kestner jubilee

We were privileged to attend, as special friends of the company, the Jubilee dinner of the Kestner Evaporator and Engineering Co., Ltd., at the Savoy Hotel, London, on October 21. We recall with pleasure a similar dinner held six years ago on the occasion of the 80th birthday of the founder and chairman of the company, Mr. J. Arthur Reavell.

Mr. Reavell is now 86 and is still in active control of the company he formed in 1908.

Congratulations to J.A.R. and to Kestners.

K.I.D. exemptions

The Treasury have made an Order under Section 10(5) of the Finance Act, 1926, exempting the following chemicals from Key Industry Duty until December 31, 1958:

a-Anhydroglucochloral

a-Anhydroglucochloral
Beuzocaine (an aminobenzoic ester)
Butacaine sulphate (an aminobenzoic ester salt)
3-Chioroaniline
N-p-Chiorobenzenesulphonyl-N'-n-propylurea (a substituted aryisulphonamide)
2: 6-Diamino-3-phenylazopyridinium chloride (a substituted aminopyridine salt)
N-Diethylaminoethylecilulose (a cellulose ether)
Ethylene brassylate (an ethylene glycol ester)
Ethyl 13: 14-di-iodobehenate (an ethyl ester)
2-Ethylhevyl acrylate (an octyl ester)
Ethyl a-hydroxy-a-methyl-n-butyrate (an ethylester)
ester)

ester)

Ethyl linoleate (an ethyl ester)

N-Ethyl-N'-(5-nitro-2-thiazolyl)urea (a substituted aminothiazole)

N-Ethyl-3-piperidyl benzilate methobromide (a benzilic ester)

N-Ethyl-3-piperidyl diphenylacetate hydrochloride (a diphenylacetic ester)

3: 2-Mercurioxy-4-nitrotoluene (a mercury compound)

pound)
Potassium persulphate
Sodium xanthate.

Company finance

Glaxo Laboratories Ltd. Subject to completion of audit, the profits of the Group for the year ended June 30 amount to £2,610,566 (£1,838,000) after providing for all charges, including £3,148,000 (£2,332,000) for taxation. Outside shareholders participate to the extent of £62,000 (£26,000) in these profits, while £168,000 (nil) is attributable to the pre-acquisition profits of Allen and Hanburys Ltd. Group profits include revenue of previous years £136,000 (£88,000).

Smith and Nephew Associated Companies. The group turnover for the half-year to June 30, 1958, is 5% higher than for the same period of the previous year. Estimated profit, before tax, for the second quarter is £510,000, making a total for the half-year of £1,050,000, a 14% increase over the combined earnings of the three merged companies.

Thomas Hedley and Co. Ltd. Net profit is £4,811,028, an all-time record for the company. The Procter and Gamble international group of companies, of which Hedley is the British member, reports profits for the year ended June 30, 1958, after tax at £26,141,649.

Packaging

Sealing polythene and paper

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The Sticla adhesive sealing machine is stated to seal horizontally both polythene and paper bags in sizes up to 56 lb. An optional feature of the sealer is a nylon rip cord which goes through the top of the seal and enables the bag to be opened easily. The manufacturers claim that bags are hermetically sealed and that the method obviates bunching at the top of the bag.

Plastic bag for liquids

A new type of package for liquids and powders is to be marketed in Britain at the beginning of 1959 by Iridon Ltd., one of the Commercial Plastics Group of companies. To be known as the Cubitainer, it consists of an outer corrugated cardboard cube which supports and protects an internal, semi-rigid polythene container.

The manufacturers state that ordinary assembly and filling lines can be adapted for the containers. The collapsed polythene container is inflated by air pressure and inserted in the cardboard outer, and the container is then filled through its open spout. The spout is closed by heat sealing, folded into the box and the box closed and sealed.

To empty the container the spout is pulled through the pour aperture and cut open along the edge. The hand grip on each side of the box (5 gal. size only) ensures easy pouring and handling. A special closure can be used if the container is not emptied. Sizes available are 5 gal., 1 gal. and 1 quart.



Fitted rubber bands and cushions give increased protection to carboys packed in this plywood barrel. The design has been approved by British Railways and the Ministry of Transport and Civil Aviation.

Plastic packaging net

Netlon is a continuously extruded thermoplastic net, claimed to be suitable for a wide variety of purposes. It is stated that it is possible, by combining the basic characteristics, to obtain an infinite range of nets.

The basic filaments can be produced in a large number of thermoplastics including polythene, pvc, cellulose acetate, nylon, etc. There are eight standard colours: black, white, cream, yellow, orange, red, blue and green, but for special orders, where the length of run justifies it, almost any other colour can be matched.

Standard supplies are made in 1,800 ft. lengths and the product is also available from the manufacturers. Spicers Ltd., in bag form, heat-sealed at one end, in 8 and 24 in. lengths.



Plywood carboy pack

Safety and economy are said to be combined in a new development in the packing of carboys of acid and dangerous chemicals, developed by Venesta Ltd.

The new pack is a plywood barrel with an inner plywood sleeve insulated against the exterior wall by rubber bands, with rubber cushions at the top and bottom. The barrel is made in two parts. The lower part is of 4 mm. plywood with two body bands, the base being secured by double closing A 1 in. thick rubber disc, 10 in. in diameter, with a 6 in. centre hole is fixed to the base. The inner sleeve is also of 4 mm. plywood and is fitted into the outer container with two 1 in. by ½ in. rubber bands. Two ¼ in. dia. steel rings are fixed to the top outside face of the inner sleeve which extends to 21 in. below the top exterior. These rings are used to secure the carboy in position with wire or

The top portion of the barrel is similar in construction to the bottom. The lid is secured with double closing hoops, and is separated from an inner disc by an embushment 3½ in. wide. This inner disc has a 4 in. hole to take the neck of the carboy, and has a 6 in. dia. rubber ring affixed which is pierced with a 3½ in. centre hole. An embushment of 4 mm. plywood 3½ in. wide secures the inner disc, and projects 2 in. below the top to engage the lower portion of the barrel, the whole being secured by three toggle fasteners.

The carboy barrel is at present available in a size 24½ in. high, the inside depth between cushions being 21½ in. and the inside diameter of the sleeve 12 in. Other sizes can, however, be manufactured.



Foil-packed tablets for export

Penny packs

Aluminium foil is being used for penny packets of headache tablets for export to West Africa. The packs contain four aspirin-caffeine tablets from Neo-Laboratories Ltd., an associate of Wallace Manufacturing Chemists Ltd.

The Venesta foil is 0.03 mm. thick with a vinyl copolymer heat seal coating on the unprinted side. On one side of the pack the title of the product and details of the chemical content are printed, while the reverse side carries dosage instructions.

*

Reinforced strapping tape

A new rayon reinforced strapping tape has been added to the Gosheron range of self-adhesive tapes. It is claimed to have a tensile strength of 120 lb. per in. and an adhesion value of 31 oz. per in. width. Transostrap is said to bond itself to a carton forming an integral part of the container. Advantages of using the tape are claimed to be: Impact stresses are absorbed by the carton itself, when it is reinforced with tape; maximum strength is obtained without fear of the tape cutting into the carton and damaging the contents; the sides of the carton are securely bonded together and, being flexible, any changes in volume are followed by the tape, so that impact stresses are jointly absorbed by the board and the tape acting as one; the reinforcement does not work loose.

Transostrap is available in 50 yd. rolls on 2 in. cores in widths of $\frac{3}{8}$ in., $\frac{1}{4}$ in. and $1\frac{1}{4}$ in. The basic material is a vinyl film reinforced with parallel rayon threads (12 threads per 30 mm. ($1\frac{1}{4}$ in.)).

News from Abroad

ISRAEL

Process sold

Fertilisers and Chemicals Ltd. have concluded a contract for the sale of "know-how" for the production of dicalcium phosphate to Krebs and Co. of Paris, who are erecting a DCP plant in accordance with this process in Belgium."

UNITED STATES

"Vision" drug

Kreidl K.G. of Vienna have acquired the United States rights for a new drug to improve the eyesight in dusk and at night. The new drug is a combination of vitamin A and a botanical substance cultivated and purified by an Austrian pharmaceutical firm. Dr. Kreidl believes that this drug, approved by the Austrian health authorities, should be marketed in the United States both as an ethical drug for the armed forces, civilian defence and pathological cases of nightblindness, and as a non-prescription drug for motorists.

A.C.S. award

The Fritzsche Prize of the American Chemical Society, which is given each year for work of fundamental importance in the field of the chemistry of natural substances, has been awarded to Academician František Sorm, Vice-President of the Czechoslovak Academy of Sciences, for research on terpenes.

Academician Sorm has been engaged for a number of years in research into the isolation and structure of terpenes. More than 30 plant substances have already been isolated in pure form at the Chemical Institute of the Academy and structures discovered that were previously not known to have existed in nature.

Colgates' biological laboratory

The Colgate-Palmolive Co. is to build a laboratory for biological research adjacent to Rutgers University, New Brunswick, New Jersey. It is to be completed in spring 1959.

The laboratory has as its stated objective "the pursuit and discovery of fundamental biological knowledge which can be applied to both the improvement of existing products and the development of new products important to the company's future growth and expansion."

Dr. J. Migliarese, formerly of Rutgers University staff, has been appointed head of the laboratory. He is a biochemist.

NORWAY

Opium salvaged from U-Boat

One ton of opium to the value of approximately £6,250 was found in the German submarine U-843, sunk in Norwegian waters during the war. It has now been raised by the Norwegian salvage company Hovding.

Although the opium has been submerged for about 13 years, it has been well preserved owing to the terrific pressure to which the containers have been exposed. This quantity is enough to cover three years' average consumption of opium alkaloids in Norway.

AUSTRALIA

Factory sold

Chemical Materials Ltd., Sydney, recently acquired the chemical business of Alderson Products Pty. Ltd., St. Leonards, New South Wales, consideration for which was 50,000 ordinary shares of 2s. 6d. each plus a cash payment. The plant is being transferred to Glebe.

Tariff enquiry

The Australian Tariff Board is to enquire whether assistance should be accorded the production in Australia of zine and sodium dialkyl dithiocarbamates; zine and sodium alkylene bis-dithiocarbamates; tetra methyl thiuram disulphide; and diphenylamine and phenothiazine; and if so found, the nature and extent of such assistance.

Value of industrial journals

"In any country the industrial journals should receive the great majority of advertising placements for machinery and industrial products and services," said Prof. Neil H. Borden, professor of marketing and advertising at the Graduate School of Business Administration, Harvard, U.S.A., when he visited Australia recently. "With other classes of goods," he said, "the main question when deciding proportionate allocations to the trade journals and to other advertising is: "What job does your advertising have to do and what people do you have to inform?"

"Where the trade is a big user of a product, the trade journal is a very important part in the marketing set-up, and big use should be made of it.

"Even in instances where trade papers do not play a big part regularly for some product or service, there will be important messages which the advertiser will wish to bring to the trade from time to time."

NEW ZEALAND

Allenbury's company

Allen and Hanburys (N.Z.) Ltd., P.O. Box 395, Wellington, New Zealand, has recently been incorporated in New Zealand. The directors are: Mr. G. E. V. Rowe, chairman and managing director, Mr. C. W. Maplethorpe and Mr. J. B. Steel.

HOLLAND

Heart drug

At Haarlem U.S.-Dutch pharmaceutical concern Merck, Sharp and Dohme Nederland NV will construct another plant for the production of a new drug for heart diseases, 6-chloro-7-sulphamyl 1,2,4 benzothiadiazine. With the new factory the company's total investment will be increased from 3-8 to 6-8 million guilders.

225 Years of Dobbelman soap

Dobbelman Royal Soap Factories at Nijmegen have celebrated their 225th anniversary. The company is the greatest independent producer of soap, cosmetics and allied products in the Netherlands. Since 1945 large-scale modernisation has been undertaken. Dobbelman now disposes of up-to-date factories employing over 400 persons. Fifteen products are made, all sold under the trade name Castella. A great deal of the production is exported to Continental and overseas countries.

Chemical industry turnover

The annual report for 1957 of the Dutch chemical industry shows that it has now achieved third place in the listing of industrial turnovers. Holland now accounts for approximately 1% of world output and 4% of world exports of chemical products. The Dutch chemical industry exported (in 1957) 49% of its output valued at 1,217 million guilders.

Naarden results

N.V. Chemische Fabriek Naarden (Chemical Works Naarden Ltd.) state in its annual report that in 1957 net profit amounted to fls. 700,000. Turnover was 6% up on 1956, and exports represented nearly 75% of the total turnover (73·5% in 1956).

The company manufactures essential oils, synthetic perfumes, fruit essences, etc.

The theobromine and caffeine factories and the plant producing sodium benzoate and benzoic acid preservatives worked to capacity throughout 1957. The departments producing fruit essences and perfume compounds reached a 20% higher turnover.

New Products

Perfumery and flavouring material

Cyclopentanone, manufactured by Price's (Bromborough) Ltd., is a saturated cyclic monoketone which occurs naturally in light wood-tar oils. It is an almost colourless mobile liquid with a characteristic odour and is of particular interest in the field of synthetic perfumery and flavouring materials. Its use as an insecticide has also been claimed, and as a shrinking agent for stretched cellulose acetate rayon.

Veterinary specific

Ultracortenol is a microcrystalline aqueous suspension of prednisolone trimethylacetate, developed for veterinary use by Ciba Pharmaceutical Products Inc.

The product is said to be particularly indicated for ketosis and shock syndrome in milk cattle. Other indications are non-specific dermatitis and inflammatory conditions involving the joints and accessory structures, and inflammatory conditions of other organs.

Procion Rubine B

This homogeneous reactive dyestuff represents an extension to I.C.I. Dyestuffs Division's Procion range. Its chief feature is said to be its ability to produce shades of high light fastness on cellulosic fibres, the dyeings also possessing high wash fastness and, in the case of cotton, good chemical fastness. The high light fastness on viscose rayon is virtually undiminished by any of the usual resin finishes.

Procion Rubine B is of special interest as a basis for fast-to-light pinks. bluish reds and bordeaux shades, and generally as the red component in mixtures. A wide range of fast-to-light mode shades, suitable for all three types of resin finishing, is reported to be obtained from the new product in combination with Procion Yellow R and Procion Brilliant Blue R. The new dye is applicable to cellulosic fibres by all the established methods for Procions, continuous or batchwise.

In textile printing applications, say I.C.I., Procion Rubine B is notable for its rapid fixation, by non-steam as well as by steaming processes, and prints of very good light and wet fastness are

Procion Rubine B should be of considerable interest to dvers and printers of natural silk, as the fastness to light and to wet treatments on this fibre is claimed to be of a very high order. A useful characteristic is the suitability for discharge-printing in pale depths of shade on silk. Procion Rubine B also gives fast dischargeable shades on nylon.

New range of oleines

In the new range of Priolene oleines introduced by Price's (Bromborough) Ltd. all the principal grades are available to three different colour standards. This enables the buyer to make separate decisions on the specification of the material he requires. and the colour standard which is necessary.

Priolene 95 is a concentrated oleic acid with a very low content of polyunsaturated and saturated fatty acids (2% and 5% respectively). Suggested uses for it are in disinfectants, esters, emulsifiers, shampoos, rayon finishes, textile lubricants and duplicator stencils.

Foam inhibitors

Foam inhibitors for industrial use are now available from the silicones department of the Union Carbide International Co. The new products are available in two forms, Sag 47 silicone fluid for non-aqueous systems and Sag 470 silicone emulsion for aqueous foaming systems.

The silicone antifoam fluid is a 100% solids solution which can be used at full strength, as a solvent solution, or blended with other materials. The antifoam emulsion contains 10% silicone solids by weight, and is ready for use, but can be further diluted if desired.



Compound fertiliser

A new granular compound fertiliser, KayNitro, is announced by Imperial Chemical Industries Ltd., for use on grassland, and also on cereals and green crops. It contains 16% nitrogen and 16% potash (K₂O), but no and 16% potash (K₂O), but no phosphate. The fertiliser is intended for use where phosphate is not required, for example on land which has been well slagged and therefore has enough available phosphate.

Experiments have shown that the use of nitrogen fertilisers in intensive grass production must be balanced by regular dressings of potash. Previously this has meant making separate applications of potash, or using compounds which supply more phosphate than is needed. Now both nitrogen and potash can be applied at the same time in one granular fertiliser; and the potash is in a form which stores well and can be applied easily.

Other agricultural uses for KayNitro are on cereals and green crops grown land adequately supplied with available phosphate.

KayNitro costs £26 17s. 6d. per ton (in minimum 6-ton lots delivered to buver's nearest railway station).

Oral hypoglycaemic

A new oral hypoglycaemic agent is now being made available to diabetic clinics by Pfizer Ltd. Known as Diabinese, its release in this country follows favourable reports of its action at an international conference held recently in New York. An arylsulphonylurea drug, Diabinese (chlorpropamide) is indicated mainly for uncomplicated diabetes mellitus of the stable, mild or moderately severe non-ketotic, maturity-onset or adult type. It is not a substitute for insulin and only certain patients with diabetes mellitus are suitable for Diabinese therapy.

Antifoam emulsion

Midland Silicones Ltd. are now marketing MS Antifoam Emulsion RD, claimed to be the cheapest silicone defoamer on sale today. It is an oil-in-water emulsion which disperses quickly in cold water, or may be added direct to a foaming system without prior dilution. It is said to have good thermal stability and to be effective in very small concentrations. In practice concentrations between 10 and 500 p.p.m. are used, and 200 p.p.m. is suggested as a starting point for trials.

Solutions for ultrasonic cleaning

A new water-wash detergent and a new degreasing solvent specially compounded for use in ultrasonic cleaning equipment are being marketed in the U.S. by Narda Ultrasonics Corpn. The new products are known as Blast 1 for use as an additive to water baths and Blast 2 for use as a degreasing bath as shipped to the consumer.

Blast 1 is a blend of anionic and nonionic detergents, sodium silicate and sodium polyphosphate. It is described as odourless, nonflammable and safe for use on all surfaces. It promotes cavitation, reduces surface tension. outgasses entrained air and protects against redeposition of soil. It is used at the rate of 1 oz. per gal. of water, which can be hot or cold, hard or soft. It is recommended for ultrasonic cleaning of mechanical, electrical, electronic, electromechanical, optical parts, precious metals, castings and other parts and assemblies which can be cleaned in aqueous solutions.

Blast 2 is a solvent of the inhibited trichlorethane type. It is nonflammable, contains no carbon tetrachloride and is the least toxic of all chlorinated hydrocarbon solvents. It dries by evaporation in a few seconds and leaves no residue. It is itself moisturefree and displaces water from metal surfaces and promotes vigorous cavitation resulting in chemically clean sur-

THE CHEMICAL MARKET

ZINC OXIDE AND PALM KERNEL OIL DEARER: WAXES DOWN
LONDON.—Refined, deodorised palm kernel oil has gone up to £136 per ton;
while palm oil is reduced to £99 per ton. Silver nitrate is up to 5s. 2 5d. per oz.
and zinc oxide, B.P., has increased £7 to £109 per ton. Nicotinamide is reduced to
£3 15s. per kg. Three grades of beeswax are reduced, Sudan spot from £27 to
£26 10s., bleached white from £32 10s. to £31 and refined yellow from £29 to
£28 per cwt. Tragacanth No. 1 is reduced to £127 10s. per cwt. but pale leaf
has increased by £1 to £50.

has increased by £1 to £5	ru.
FINE CHEMIC	ALS
Acetanilide 12½ kg.	7s. 4d. kg.
Arsenious oxide B.P.	101 101 118
	1s. 9d. lb.
7-lb. lots	
1 cwt. lots	1s. 2d. lb.
Ascorbic acid	
100 kg.	£4 14s. kg.
Aspirin	
56 lb.	5s. 2d. lb.
1-cwt.	4s. 11d. "
5-cwt. lots	4s. 9d. n
Atropine	an out H
Sulphate, 500 g. & £5	190 Ad lea
Allested 700 -	9 10s. ou. kg.
Alkaloid, 500 g.	£69 10s. kg.
Benzene B.P.C. 28-lb. lots	
Benzoic acid 12½ kg.	7s. 4d. kg.
Benzyl benzoate	
According to pack 5s.	to 5s. 6d. lb.
Bismuth oxide B.P.C. 1934	
28-lb. lots	26s. 10d. lb.
	205. Tou. ID.
Bismuth salts 28-lb. lots:	00 01 11
Carbonate	22s. 3d. lb.
Subgallate	21s. 1d. ,,
Salicylate	21s. 9d. "
Subnitrate	20s. 5d. "
Borax B.P.	2001 o'di 33
	959 10-
Powder (hessian bags)	£58 10s.
" (paper bags)	£57 10s.
Extra fine (hessian bags	£59 10s.
" " (paper bags)	£58 10s.
Boric acid B.P.	
Crystal (hessian bags)	£96 10s.
Powder (begging born)	£95 10s.
,, (paper bags) Powder (hessian bags)	£94
" (paper bags)	
Bromine B.P.C.	£94
", (paper bags) Bromine B.P.C. 7-lb. lots	£94
", (paper bags) Bromine B.P.C. 7-lb. lots	£94 £93 6s. lb.
", (paper bags) Bromine B.P.C. 7-lb. lots Caffeine 50 kg.	£94 £93 6s. lb. 42s. 6d. kg.
", (paper bags) Bromine B.P.C. 7-lb. lots Caffeine 50 kg. Calamine 50 kg.	£94 £93 6s. lb.
", (paper bags) Bromine B.P.C. 7-lb. lots Caffeine 50 kg. Calamine 50 kg. Calcium gluconate	£94 £93 6s. lb. 42s. 6d. kg. 4s. kg.
, (paper bags) Bromine B.P.C. 7-lb. lots Caffeine 50 kg. Calamine 50 kg. Calcium gluconate 1 cwt. lots dlvd.	£94 £93 6s. lb. 42s. 6d. kg.
" (paper bags) Bromine B.P.C. 7-lb. lots Caffeine 50 kg. Calamine 50 kg. Calcium gluconate 1 cwt. lots dlvd. Calcium glycerophosphate	£94 £93 6s. lb. 42s. 6d. kg. 4s. kg. 3s. 7d. lb.
" (paper bags) Bromine B.P.C. 7-lb. lots Caffeine 50 kg. Calamine 50 kg. Calcium gluconate 1 cwt. lots dlvd. Calcium glycerophosphate 50 kg.	£94 £93 6s. lb. 42s. 6d. kg. 4s. kg.
" (paper bags) Bromine B.P.C. 7-lb. lots Caffeine 50 kg. Calamine 50 kg. Calcium gluconate 1 cwt. lots dlvd. Calcium glycerophosphate	£94 £93 6s. lb. 42s. 6d. kg. 4s. kg. 3s. 7d. lb.
" (paper bags) Bromine B.P.C. 7-lb. lots Caffeine 50 kg. Calamine 50 kg. Calcium gluconate 1 cwt. lots dlvd. Calcium glycerophosphate 50 kg. Calcium lactate B.P.	£94 £93 6s. lb. 42s. 6d. kg. 4s. kg. 3s. 7d. lb. 28s. 6d. kg.
" (paper bags) Bromine B.P.C. 7-lb. lots Caffeine 50 kg. Calamine 50 kg. Calcium gluconate 1 cwt. lots dlvd. Calcium glycerophosphate 50 kg. Calcium lactate B.P. 7-lb. lots	£94 £93 6s. lb. 42s. 6d. kg. 4s. kg. 3s. 7d. lb. 28s. 6d. kg. 3s. 6d. lb.
", (paper bags) Bromine B.P.C. 7-lb. lots Caffeine 50 kg. Calamine 50 kg. Calcium gluconate 1 cwt. lots dlvd. Calcium glycerophosphate 50 kg. Calcium lactate B.P. 7-lb. lots 1-cwt. lots	£94 £93 6s. lb. 42s. 6d. kg. 4s. kg. 3s. 7d. lb. 28s. 6d. kg. 3s. 6d. lb. 2s. 11d. n
" (paper bags) Bromine B.P.C. 7-lb. lots Caffeine 50 kg. Calcium gluconate 1 cwt. lots dlvd. Calcium glycerophosphate 50 kg. Calcium lactate B.P. 7-lb. lots 1-cwt. lots Chloral hydrate 50 kg.	£94 £93 6s. lb. 42s. 6d. kg. 4s. kg. 3s. 7d. lb. 28s. 6d. kg. 3s. 6d. lb.
" (paper bags) Bromine B.P.C. 7-lb. lots Caffeine 50 kg. Calamine 50 kg. Calcium gluconate 1 ewt. lots dlvd. Calcium glycerophosphate 50 kg. Calcium lactate B.P. 7-lb. lots 1-ewt. lots Chloral hydrate 50 kg. Citric acid, B.P.	£94 £93 6s. lb. 42s. 6d. kg. 4s. kg. 3s. 7d. lb. 28s. 6d. kg. 3s. 6d. lb. 2s. 11d. n
" (paper bags) Bromine B.P.C. 7-lb. lots Caffeine 50 kg. Calamine 50 kg. Calcium gluconate 1 cwt. lots dlvd. Calcium glycerophosphate 50 kg. Calcium lactate B.P. 7-lb. lots 1-cwt. lots Cloral hydrate 50 kg. Citric acid, B.P. Powder or granulated:	£94 £93 6s. lb. 42s. 6d. kg. 4s. kg. 3s. 7d. lb. 28s. 6d. kg. 3s. 6d. lb. 2s. 11d. n 10s. kg.
" (paper bags) Bromine B.P.C. 7-lb. lots Caffeine 50 kg. Calcium gluconate 1 cwt. lots dlvd. Calcium glycerophosphate 50 kg. Calcium lactate B.P. 7-lb. lots 1-cwt. lots Chloral hydrate 50 kg. Citric acid, B.P. Powder or granulated: 1-cwt. lots	£94 £93 6s. lb. 42s. 6d. kg. 4s. kg. 3s. 7d. lb. 28s. 6d. kg. 3s. 6d. lb. 2s. 11d. n
" (paper bags) Bromine B.P.C. 7-lb. lots Caffeine 50 kg. Calamine 50 kg. Calcium gluconate 1 ewt. lots dlvd. Calcium glycerophosphate 50 kg. Calcium lactate B.P. 7-lb. lots 1-ewt. lots Chloral hydrate 50 kg. Citric acid, B.P.	£94 £93 6s. lb. 42s. 6d. kg. 4s. kg. 3s. 7d. lb. 28s. 6d. kg. 3s. 6d. lb. 2s. 11d. n 10s. kg.
" (paper bags) Bromine B.P.C. 7-lb. lots Caffeine 50 kg. Calcium gluconate 1 cwt. lots dlvd. Calcium glycerophosphate 50 kg. Calcium lactate B.P. 7-lb. lots 1-cwt. lots Chloral hydrate 50 kg. Citric acid, B.P. Powder or granulated: 1-cwt. lots 5-cwt. lots	£94 £93 6s. lb. 42s. 6d. kg. 4s. kg. 3s. 7d. lb. 28s. 6d. kg. 3s. 6d. lb. 2s. 11d. n 10s. kg.
" (paper bags) Bromine B.P.C. 7-lb. lots Caffeine 50 kg. Calamine 50 kg. Calcium gluconate 1 ewt. lots dlvd. Calcium glycerophosphate 50 kg. Calcium lactate B.P. 7-lb. lots 1-ewt. lots Chloral hydrate 50 kg. Citric acid, B.P. Powder or granulated: 1-ewt. lots 5-ewt. lots Codeine	£94 £93 6s. lb. 42s. 6d. kg. 4s. kg. 3s. 7d. lb. 28s. 6d. kg. 3s. 6d. lb. 2s. 11d. " 10s. kg. £11 5s. cwt. £11 ",
" (paper bags) Bromine B.P.C. 7-lb. lots Caffeine 50 kg. Calamine 50 kg. Calcium gluconate 1 ewt. lots dlvd. Calcium glycerophosphate 50 kg. Calcium lactate B.P. 7-lb. lots 1-ewt. lots Chloral hydrate 50 kg. Citric acid, B.P. Powder or granulated: 1-ewt. lots 5-ewt. lots Codeine Alkaloid 100 g. £10	£94 £93 6s. lb. 42s. 6d. kg. 4s. kg. 3s. 7d. lb. 28s. 6d. kg. 3s. 6d. lb. 2s. 11d. " 10s. kg. £11 5s. cwt. £11 ", 6 7s. 6d. kg.
" (paper bags) Bromine B.P.C. 7-lb. lots Caffeine 50 kg. Calamine 50 kg. Calcium gluconate 1 cwt. lots dlvd. Calcium glycerophosphate 50 kg. Calcium lactate B.P. 7-lb. lots 1-cwt. lots Choral hydrate 50 kg. Citric acid, B.P. Powder or granulated: 1-cwt. lots 5-cwt. lots Codeine Alkaloid 100 g. £10 Phosphate 100 g.	£94 £93 6s. lb. 42s. 6d. kg. 4s. kg. 3s. 7d. lb. 28s. 6d. kg. 3s. 6d. lb. 2s. 11d. " 10s. kg. £11 5s. cwt. £11 ",
" (paper bags) Bromine B.P.C. 7-lb. lots Caffeine 50 kg. Calcium gluconate 1 cwt. lots dlvd. Calcium glycerophosphate 50 kg. Calcium lactate B.P. 7-lb. lots 1-cwt. lots Chloral hydrate 50 kg. Citric acid, B.P. Powder or granulated: 1-cwt. lots 5-cwt. lots Codeine Alkaloid 100 g. £10 Phosphate 100 g. Cream of tartar	£94 £93 6s. lb. 42s. 6d. kg. 4s. kg. 3s. 7d. lb. 28s. 6d. kg. 3s. 6d. lb. 2s. 11d. " 10s. kg. £11 5s. cwt. £11 ",
" (paper bags) Bromine B.P.C. 7-lb. lots Caffeine 50 kg. Calcium gluconate 1 cwt. lots dlvd. Calcium glycerophosphate 50 kg. Calcium lactate B.P. 7-lb. lots 1-cwt. lots Chloral hydrate 50 kg. Citric acid, B.P. Powder or granulated: 1-cwt. lots 5-cwt. lots Codeine Alkaloid 100 g. Phosphate 100 g. Cream of tartar 1-cwt. lots	£94 £93 6s. lb. 42s. 6d. kg. 4s. kg. 3s. 7d. lb. 28s. 6d. kg. 2s. 11d. " 10s. kg. £11 5s. cwt. £11 ", 6 7s. 6d. kg. £110 ",
" (paper bags) Bromine B.P.C. 7-lb. lots Caffeine 50 kg. Calamine 50 kg. Calcium gluconate 1 ewt. lots dlvd. Calcium glycerophosphate 50 kg. Calcium lactate B.P. 7-lb. lots 1-cwt. lots Chloral hydrate 50 kg. Citric acid, B.P. Powder or granulated: 1-cwt. lots 5-cwt. lots Codeine Alkaloid 100 g. Phosphate 100 g. Cream of tartar 1-cwt. lots 5-cwt. lots	£94 £93 6s. lb. 42s. 6d. kg. 4s. kg. 3s. 7d. lb. 28s. 6d. kg. 3s. 6d. lb. 2s. 11d. " 10s. kg. £11 5s. cwt. £11 ",
" (paper bags) Bromine B.P.C. 7-lb. lots Caffeine 50 kg. Calamine 50 kg. Calcium gluconate 1 ewt. lots dlvd. Calcium glycerophosphate 50 kg. Calcium lactate B.P. 7-lb. lots 1-cwt. lots Chloral hydrate 50 kg. Citric acid, B.P. Powder or granulated: 1-cwt. lots 5-cwt. lots Codeine Alkaloid 100 g. Phosphate 100 g. Cream of tartar 1-cwt. lots 5-cwt. lots	£94 £93 6s. lb. 42s. 6d. kg. 4s. kg. 3s. 7d. lb. 28s. 6d. kg. 2s. 11d. " 10s. kg. £11 5s. cwt. £11 ", 6 7s. 6d. kg. £110 ",
" (paper bags) Bromine B.P.C. 7-lb. lots Caffeine 50 kg. Calamine 50 kg. Calcium gluconate 1 ewt. lots dlvd. Calcium glycerophosphate 50 kg. Calcium lactate B.P. 7-lb. lots 1-ewt. lots Chloral hydrate 50 kg. Citric acid, B.P. Powder or granulated: 1-ewt. lots 5-ewt. lots Codeine Alkaloid 100 g. Phosphate 100 g. Cream of tartar 1-ewt. lots 5-ewt. lots 5-ewt. lots 6-ewt. lots 6	£94 £93 6s. lb. 42s. 6d. kg. 4s. kg. 3s. 7d. lb. 28s. 6d. kg. 3s. 6d. lb. 2s. 11d. " 10s. kg. £11 5s. cwt. £11 ", 6 7s. 6d. kg. £110 ",
" (paper bags) Bromine B.P.C. 7-lb. lots Caffeine 50 kg. Calcium gluconate 1 cwt. lots dlvd. Calcium glycerophosphate 50 kg. Calcium lactate B.P. 7-lb. lots 1-cwt. lots Chloral hydrate 50 kg. Citric acid, B.P. Powder or granulated: 1-cwt. lots 5-cwt. lots Codeine Alkaloid 100 g. £10 Phosphate 100 g. Cream of tartar 1-cwt. lots 5-cwt. lots 5-cwt. lots Ephedrine 500 g. lots Hydrochloride 3 kg. £6	£94 £93 6s. lb. 42s. 6d. kg. 4s. kg. 3s. 7d. lb. 28s. 6d. kg. 3s. 6d. lb. 2s. 11d. " 10s. kg. £11 5s. cwt. £11 ", 6 7s. 6d. kg. £110 ", £110 ", £110 ", £110 ",
" (paper bags) Bromine B.P.C. 7-lb. lots Caffeine 50 kg. Calcium gluconate 1 cwt. lots dlvd. Calcium glycerophosphate 50 kg. Calcium lactate B.P. 7-lb. lots 1-cwt. lots Chloral hydrate 50 kg. Citric acid, B.P. Powder or granulated: 1-cwt. lots 5-cwt. lots Codeine Alkaloid 100 g. Phosphate 100 g. Cream of tartar 1-cwt. lots 5-cwt. lots 5-cwt. lots Ephedrine 500 g. lots Hydrochloride 3 kg. £6 Alkaloid 3 kg.	£94 £93 6s. lb. 42s. 6d. kg. 4s. kg. 3s. 7d. lb. 28s. 6d. kg. 2s. 6d. lb. 2s. 11d. " 10s. kg. £11 5s. cwt. £11 ", 6 7s. 6d. kg. £110 ", 11 15s. cwt. 11 13s. ", 12s. 3d. kg. £12 7s. kg.
" (paper bags) Bromine B.P.C. 7-lb. lots Caffeine 50 kg. Calcium gluconate 1 cwt. lots dlvd. Calcium glycerophosphate 50 kg. Calcium lactate B.P. 7-lb. lots 1-cwt. lots Chloral hydrate 50 kg. Citric acid, B.P. Powder or granulated: 1-cwt. lots 5-cwt. lots Codeine Alkaloid 100 g. Phosphate 100 g. Cream of tartar 1-cwt. lots 5-cwt. lots 5-cwt. lots 5-cwt. lots 5-cwt. lots 6-cwt. lots 6-cwt	£94 £93 6s. lb. 42s. 6d. kg. 4s. kg. 3s. 7d. lb. 28s. 6d. kg. 3s. 6d. lb. 2s. 11d. " 10s. kg. £11 5s. cwt. £11 ", 6 7s. 6d. kg. £110 ", £110 ", £110 ", £110 ",
" (paper bags) Bromine B.P.C. 7-lb. lots Caffeine 50 kg. Calamine 50 kg. Calcium gluconate 1 ewt. lots dlvd. Calcium glycerophosphate 50 kg. Calcium lactate B.P. 7-lb. lots 1-ewt. lots Chloral hydrate 50 kg. Citric acid, B.P. Powder or granulated: 1-ewt. lots 5-ewt. lots Codeine Alkaloid 100 g. Phosphate 100 g. Cream of tartar 1-ewt. lots 5-ewt. lots Ephedrine 500 g. lots Hydrochloride 3 kg. Alkaloid 3 kg. Sulphate 3 kg. £6 Eucalyptol	£94 £93 6s. lb. 42s. 6d. kg. 4s. kg. 3s. 7d. lb. 28s. 6d. kg. 3s. 6d. lb. 2s. 11d. " 10s. kg. £11 5s. cwt. £11 ", 6 7s. 6d. kg. £110 ", 11 15s. cwt. 11 13s. ", 12s. 3d. kg. £12 7s. kg. 12s. 3d. ",
" (paper bags) Bromine B.P.C. 7-lb. lots Caffeine 50 kg. Calamine 50 kg. Calcium gluconate 1 ewt. lots dlvd. Calcium glycerophosphate 50 kg. Calcium lactate B.P. 7-lb. lots 1-ewt. lots Chloral hydrate 50 kg. Citric acid, B.P. Powder or granulated: 1-ewt. lots 5-ewt. lots Codeine Alkaloid 100 g. Phosphate 100 g. Cream of tartar 1-ewt. lots 5-ewt. lots Ephedrine 500 g. lots Hydrochloride 3 kg. Alkaloid 3 kg. Sulphate 3 kg. £6 Eucalyptol	£94 £93 6s. lb. 42s. 6d. kg. 4s. kg. 3s. 7d. lb. 28s. 6d. kg. 2s. 6d. lb. 2s. 11d. " 10s. kg. £11 5s. cwt. £11 ", 6 7s. 6d. kg. £110 ", 11 15s. cwt. 11 13s. ", 12s. 3d. kg. £12 7s. kg.
" (paper bags) Bromine B.P.C. 7-lb. lots Caffeine 50 kg. Calcium gluconate 1 cwt. lots dlvd. Calcium glycerophosphate 50 kg. Calcium lactate B.P. 7-lb. lots 1-cwt. lots Chloral hydrate 50 kg. Citric acid, B.P. Powder or granulated: 1-cwt. lots 5-cwt. lots Codeine Alkaloid 100 g. Phosphate 100 g. Cream of tartar 1-cwt. lots 5-cwt. lots 5-cwt. lots 5-cwt. lots 5-cwt. lots 6-cwt. lots 6-cwt	£94 £93 6s. lb. 42s. 6d. kg. 4s. kg. 3s. 7d. lb. 28s. 6d. kg. 3s. 6d. lb. 2s. 11d. " 10s. kg. £11 5s. cwt. £11 ", 6 7s. 6d. kg. £110 ", 11 15s. cwt. 11 13s. ", 12s. 3d. kg. £12 7s. kg. 12s. 3d. ",

FT 1 - 14 - 4 - 1	n n
Ferri ammonium citrate	
1-cwt. lots, scales	4s. 8d. lt
1-cwt. lots, granules	3s. 11d.,
Ferrous gluconate	
1 cwt. lots dlvd.	6s. 3d. lb
Gallic acid B.P.C.	
1-cwt. lots	10s. ,
Glycerophosphoric acid	
24 litres	11s. 10d. litr
Glycine (amino acetic aci	id)
12½ kg.	18s. 10d. kg
Hexyl resorcinol 10 kg.	£7 10s. kg
Hydroquinone 12½ kg.	23s. 10d. kg
Iodides	
Ethyl	00 011
4 kg. bottles	62s. 9d. kg
Mercury, red B.P.C.	
28-lb. lots	27s. 1d. lb
1-cwt. lots	24s. 9d. "
Potassium B.P.	0 01
28-lb. lots	8s. 0d. "
1-cwt. lots	7s. 3d. "
Sodium B.P.	
28-lb. lots	13s. "
1-cwt. lots	12s. 9d. "
Iodine, Chilean crude,	
99% min. in wooden	casks 15s. kg
Iodoform	
12½ kg. and under 50 k	
Lactose 50 kg.	3s. 2d. kg
Lithium salts 5-cwt. lots	9
Benzoate	10s. lb
Carbonate B.P.C.	11s. 3d. "
Chloride (commercial)	
	11s. ,,
" granular	10s. 9d. "
Hydroxide	9s. 9d. "
Citrate B.P.C.	9s. "
Sulphate	8s. 6d. ,,
Salicylate, 10 cwt., dl Magnesium carbonate B.I	vd. 9s. 9d. "
Light cwt. lots dlvd.	£129 ton
Magnesium trisilicate	
28-lb. packages	
28-lb. lots	4s. 3d. lb.
1-cwt. lots	3s. 10d. "
5-cwt. lots	3s. 7d. "
Bulk rates for larger	
from 8s. 1d. lb. it	1 ton lots
Manganese hypophosphite	B.P.C.
7-lb. lots	13s. 11d. lb.
1-cwt. lots	12s. 11d. "
Mercuric chloride B.P.	
50-kg. lump	48s. 6d. kg.
Methyl salicylate 1-cwt. le	
Morphine	000 000 000 ID
	20 100 44 1
Alkaloid, 100 g. £13	
Nicotinamide 1 kg.	£3 15s. kg.
Nicotinic acid	FO- 01 1
121 kg.	52s. 6d. kg.
1 kg.	55s. ,,

*		
	Oleine, B.P. extra	pale, 3/4 cwt. drums
2	returnable carri	age paid G.B.
		£160 ton
)	Phenolphthalein 50	
)	Phosphoric acid B.	
f		arboy lots 1s. 4d. lb.
I.	Potassium permang	
	1-cwt. lots dlvd.	is. 11 d. lb. ride (foreign) 2 kg.
	1 Totalic liyurocillo	59s. kg.
	Quinine 1 oz. lots	4s. 4d. oz.
	Riboflavin	200 200 000
	100 g.	5½d. g.
	10 g.	7d. "
	Saccharin	
		4s. for this quantity
	Salicylic acid	
		3s. 2½d. to 5s. 6d. lb.
	Silver nitrate	En 0 5 J
	500 g.	5s. 2 5 d. oz.
	Sodium benzoate B.	2s. 9\d. lb.
	1-cwt. lots 1-ton lots	2s. 7 d. ib.
	Sodium salicylate	20. 1 gu. 33
	50 kg.	8s. 8d. kg.
	12½ kg.	9s. "
	Sodium thiosulphate	
	Crystals, photog	raphic quality
	1-ton lots	49s. cwt.
	Stearic acid B.P.C.	flake, carriage paid
	G.B.	£154 ton
	Strychnine 25 oz.	
	Alkaloid	8s. 6d.
	Hydrochloride	8s. 6d.
	Sulphate	7s. 6d.
	Sulphaguanidine	•
	12½ kg.	33s. kg.
	50 kg.	32s. "
	Sulphanilamide	160 6d kg
	12½ kg.	16s. 6d. kg. 15s. 4d. ,,
	50 kg. Sulphathiazole 12‡	
	Tannic acid B.P. Le	
	1-cwt. lots	10s. lb.
	Tartaric acid B.P.	
	Powder or granu	lated,
	10 cwt. or mor	
	Terpineol, B.P.	
	40-gal. drums	2s. 5d. lb.
	1-cwt. lots	2s. 8d. "
	Theophylline, B.P.	1 0 111 11
		d. for this quantity
	Thiamine hydrochlor	
	100 g.	4d. g.
	1 kg. Thioglycollate	£13 7s. 6d. kg.
	Ammonium 19	s. 4d. to 16s. 4d. lb.
	Calcium:	
	7-lb. lots	17s. 3d. "
	5-cwt. lots	14s. 3d. ,,
	a-Tocopherol 25-g. 1	
	Vanillin	26s. to 30s. 6d. lb.
	Zinc oxide, B.P.	
	2-ton lots	£109 ton
	GENERAL C	CHEMICALS
	Acetic acid 1-ton lo	
	80% Technical 80% Pure	£105 "
	Glacial B.P.	£114 "
	99-100% Glacial	

£108 "

99-100% Glacial 98-100% Glacial

Acetic anhydride	Magnesium chloride	Sodium sulphate Ex works:
1-ton lots dlvd. £136 to	n Solid (ex wharf): 1-ton lots £17 10s. tor	(Glauber salt) £13 ton
Acetone	Magnesium sulphate	(Salt cake) unground, full truck loads £8 16s. 6d. ton
5-gal. drums, free, non-returnable £128 to		
40 to 45-gal. drums, 10-ton lots	Mercurous chloride (calomel)	Broken, returnable drums, dlvd. ton
£88 ,	50 kg. 65s. kg	
Alum, potassium granular crystals	Mercury sulphide, red	Flake, ditto £38 12s. 6d. ,,
50 kg. 1s. 2d. kg		
Aluminium hydroxide B.P.C. 34 28-lb. lots 2s, 4d, ll	Methylated spirits (Industrial)	Sodium sulphite Commercial crystals 4-ton lots
28-lb. lots 2s. 4d. ll Aluminium stearate	a criminary quantry ooo gui.	£24 10s. ,,
(Precipitate) 1-ton lots £258 10s. to	upwards: n 61 o.p. 7s. 4d.	(Dlad I and an in I aust single non
Ammonia	74 o.p. 7s. 11 d.	returnable bags)
Persulphate £6 2s. 6d. cw		Sodium tripolyphosphate
Phosphate: Mono- £106 to	61 o.p. 8s. 8d.	1-ton lots £95 ton
Di- £100 ,,		Stannic chloride 28-lb. lots 8s. 11d. lb. Stannous chloride 28-lb. lots 9s. 5d. lb.
Amyl acetate	Methyl ethyl ketone	Ctuantium conhanata
B.S.S. 10 tons and over £251 to £249		96-98% 28-lb. lots 3s. lb.
Amyl alcohol	Methyl isobutyl carbinol	Sulphuric acid, ex-works, according to
Technical in 1-ton lots £260 to	10 tons and up, in drums, dlvd.	quality and quantity
Arsenic White powdered ex store	Methyl isobutyl ketone	B.O. V. 78% from 8s. to 10s. cwt.
£37-£38 to	10 to 50 tons, in drums, dlvd.	C.O.V. 96% from 11s. to 14s. cwt.
n-Butyl acetate	£169 ton	Zinc chloride
10-ton lots £173 to	1 depitement of the second	28-lb. lots sticks 6s. 9d. lb.
n-Butyl alcohol	Crystal, dlvd., 4-ton lots, spot	OILS AND FATS
10-ton lots £149 to	400 401 041 1011	Palm kernel oil
Solid 70 to 72%, 4-ton lots dlvd.	Ball and flake (ditto) £73 14s. 3d. ,,	Refined, deodorised, 2-ton lots,
£17 10s. to	Nickel sulphate dlvd. ton lots £195 10s. ton	naked, ex works £136 ton
Calcium oxide (Lime)	Nitric acid 70% intermediate £32 ,,	Palm oil
Ex marble 28-lb. lots 3s. 10d. lb	Pentachlorphenol	Refined, deodorised, 2-ton lots,
Caustic soda	Flake, technical, 1-ton lots, dlvd.	naked, ex works £99 ton Stearine
Solid 1-ton lots, from £37 0s. 6d. to	2s. 2d. lb.	dlvd. free bags
Chloroform B.P. 1-ton lots 3s. 11d. lb	- months only others.	Pristerene 64 flake £148 ton
Chromic acid	Under 1 ton divd. from 1s. 7d. lb.	Pristerene 62 flake £133 ,,
Dlvd. U.K. (less 2½%)	10 tons and over dlvd. in returnable	Pristerene 61 flake £113 ,,
2s. 0¼d. to 2s. 0¾d. lb DDT		A premium of £2 ton is charged for
2 : 4-Dichlorophenoxyacetic acid	10 ton lots in drums	powder and £4 for block
99% pure, 1-cwt. bags £330 tor		GUMS AND WAXES
Dimethyl sulphate 400 lb. drum lots	Dimethyl (B.S.) £179 ton	Agar Agar No. 1
1s. 8d. lb		Kobe strip 11s. 9d. lb.
Ether (Diethyl ether)	50 kg. 5s. 6d. kg.	Powder 17s. 0d. "
Tech. B.S.S. and Solvent B.P.	12½ kg. 5s. 8d. ,,	Beeswax
1-ton lots in drums 2s. lb		Dar-es-Salaam spot (nominal)
Ethyl acetate 10-ton lots £145 tor Ethyl alcohol	Calcined 96 to 98% (1-ton lots ex store) £76 ton	227 10s. cwt.
95% Gay Lussac 66.0 o.p.	Hydrated (1-ton lots) £74 10s. "	Sudan spot (duty paid) £26 10s. ,, Bleached white (slab) £31 ,,
2,500 to over 300,000 proof gallons		Refined yellow (slab) £28 ,,
per year in tank wagons	28-lb. lots 5s. 1d. lb.	Benzoin
4s. 21d. to 4s. 01d. per proof gal.	Potassium sodium tartrate	Sumatra spot £27 cwt.
Ferrous sulphate 50 kg. 1s. 4d. kg.	5-cwt. lots £10 cwt.	Siam spot £2 7s. 6d. lb.
Formaldehyde	Soda ash	Candelilla Spot £24 cwt.
40% by volume dlvd. England		Carnauba
1-ton lots £38 15s. ton	Sodium cyanide 96-98% £128 ton	Prime, Spot £51 cwt. Fatty grey £28 1Cs. ,,
Glycerin	Sodium hydroxide 28 lb. lots:	Fatty grey £28 10s. ,, Gum arabic Lump £7 10s. cwt.
1,260 s.g. chem. pure, 5 tons and up, 5-cwt. drums £201 10s. ton	sticks (1 lb. bottles) 4s. 3d. lb.	Karaya Powder, Spot 3s. 6d. lb.
1,260 s.g. refined pale straw, indus.,		Paraffin wax
5 tons and up, 5-ewt. drums	Sodium metal 28-lb. lots 8s. 8d. ,	1-ton lots, acc. to grade
£196 10s. ton	Sodium metasilicate	£87 10s. to £120 ton
lexamine	Dlvd. U.K. in ton lots £26 ton	Peru balsam 11s. lb.
1-ton lots	Sodium phosphate	Shellac
Technical, bulk 1s. 8d. lb.	Dlvd. ton lots: Di-sodium, crystal-	No. 1 orange £13 cwt. No. 2 orange £11 10s. ,,
B.P.C. 1s. 11d. "	line £40 10s. ton	No. 2 orange £11 10s. ,, Transparent white 4s. 3d. lb.
Hydrochloric acid Commercial 18s. 6d. cwt.	Anhydrous £88 ,, Tri-sodium, crystalline £39 ,,	Pale dewaxed 6s.
Hydrogen peroxide	Tri-sodium, crystalline £39 ,, Anhydrous £86 ,,	Tragacanth
	Sodium silicate	No. 1 spot £127 10s. cwt.
27.5% weight £128 10s. ton		
27.5% weight £128 10s. ton 35% weight £158 ,,	according to quantity, grade and	No. 2 spot £121 ,,
35% weight £158 ,, Lactic acid (1-ton lots)		Pale leaf £50 "
	according to quantity, grade and	

MEETINGS

Society of Cosmetic Chemists of Great Britain

December 17. "Perfumery Chemicals," by R. A. A. Lacey. 7.30 p.m. Royal Society of Arts, John Adam Street, London, W.C.2.

Pharmaceutical Society of **Great Britain**

" Gas November 20. Chromatography in Pharmaceutical Analyses, by L. Brealey and D. Holness. 7.30 p.m. 17 Bloomsbury Square, London. W.C.1.

Institution of Chemical Engineers

November 25, "An Equation for the Performance of Machines Mixing Two Powders," by H. E. Rose, 5.30 p.m. The Geological Society, Burlington House, London, W.1.

December 10. "The Manufacture

December 10. "The Manufacture of Antibiotics," by J. Stuart. 6.30 p.m. Birmingham College of Technology, Gosta Green, Birmingham.

Royal Institute of Chemistry

November 17. "Structural Analysis of Polysaccharides," by Dr. D. J. Manners. 5.45 p.m. The Royal Institution, Albemarle Street, London, W.1.

November 19. Annual general meeting. 6.30 p.m. The Royal Society of Health, 90 Buckingham Palace Road, London, S.W.1.

"The Chemistry of November 21. Wines and Spirits," by Dr. E. C. Barton-Wright, 8.30 p.m. Tour of the University Laboratories, 4.15-6 p.m. Cambridge University Chemical Laboratories, Lensfield Road, Cambridge.

" Sequestering November 26. Agents," by Dr. J. K. Aiken. 7 p.m. Northampton College of Advanced Technology, St. John Street, London,

Society of Chemical Industry

November 19. "The 'Conveyor' Concept of Water in Industry," E. L. Streatfield, 7.45 p.m. Chemistry Department, University College, Dub-

November 20. "Lighter Aspects of Some Solid Structures," by Dr. K. H. Jack. 8.15 p.m. Department of Chemistry, The University, Durham.

November 27. "Co-ordination Com-

pounds," by Dr. T. S. West. 7.45 p.m. Chemistry Department, Queen's

University, Belfast.

December 1. "Petrochemicals in
Holland," by Dr. J. L. Edgar. 6.30
p.m. 14 Belgrave Square, London,

December 4. "Biosynthesis," by Prof. A. J. Birch. 7.30 p.m. North British Hotel, Princes Street, Edinhurgh.

December 11. "Industrial pH Measurement," by Dr. G. Mattock. 7.30 p.m. Nicholson Theatre, The "Industrial pH

University, Liverpool.

December 19. "Recent Trends in
Qualitative Analysis," by D. W.
Wilson. 7 p.m. University College, Cardiff.

Oils and Fats Group

December 8. "The Synthesis of Natural Fatty Acids," by Dr. F. D. Gunstone. 7 p.m. Royal Station Hotel, Hull.

Microbiology Group

December 4. "Freeze-dried B.C.G. Vaccine," by Dr. P. W. Muggleton and Miss J. P. Farmer; "Viral Vaccines," by Dr. J. A. Dudgeon. 6.15 p.m. 14 Belgrave Square, London, S.W.1.

Agriculture Group

December 5. "The Effects of Gibberellie Acid on Plant Growth and Development," by Dr. P. W. Brian; "The Chemistry of Gibberellic Acid," by Dr. B. E. Cross. 5.45 p.m. 14 Belgrave Square, London, S.W.1.

NEW COMPANIES

These particulars of new companies have been extracted from the daily register of Jordan and Sons Ltd., company registration agents, Chancery Lane, London, W.C. 2.

Bury Pharmacy Ltd. 10.9.58. 10 Manchester Road, Bury. £1,000. Dirs.: D. Swerling and G. Morris.

Joseph Levy and Co. Ltd. 10.9.58.

712 Romford Road, London, E.12. Mfrs. of and dlrs. in chemicals, gases, drugs, etc. £1,000. Dir.: J. Levy.

Chemists Holdings (London) Ltd. 11.9.58. Spring Bank Works, Nelson. Holding and investment company, etc. £100. Dirs.: J. N. and P. R. Hartley and J. W. Rawstron.

Ernest Morris (Chemists) Ltd. 12.9.58.
7 Chapel Street, Halton, Leeds 15. £4,000. C. H. and Muriel Morris.

Willoughby and Threlfall (Fordhouses)
Ltd. 16.9.58. 723 Stafford Road, Wolverhampton. Chemists, druggists, etc.
£500. Dirs.: Edna and John Threlfall.

D. Jones (Poplar) Ltd. 17.8.58. 267 East India Dock Road, London, E.14. Chemists, druggists, etc. £3,500. Permt.

dir.: D. Jones.

S. H. Easter (Chemists) Ltd. 18.9.58.

48 Station Lane, Hornchurch, Essex.
£100. Dirs.: S. H. and Irmgard Easter.

Hamax Ltd. 19.9.58. Glasshouse Lane, Mexborough, Yorks. Mfrs. of and dlrs. in domestic chemical preparations, soaps, cleansers. etc. £10,000. Permt. dirs.:

cleansers, etc. £10,000. Permt. dirs.: F. H. and Dorothy A. Hamer. Press-Chem Ltd. 22,9.58. 45-7 Park Road East, Acton, London, W.3. Mnfrs. of instruments for use of chemicals; chemical processing; chemical mnfrs., etc. £1,000. Dirs.: M. N. Mitchell and J. B. Jeves.

Virisin Laboratories Ltd. 22.9.58. 21 Jockeys Fields, W.C.1. Mnfg., research, dispensing and analytical chemists, etc. £100. Dirs.: Doris Carr and A. M. Nicholls.

B. Newton Maine Ltd. 22.9.58. Mnfrs. of and dirs. in pharmaceutical, medicinal, chemical, industrial and other preparations, etc. £5,000. Subs: B. and Sybil

McDermott, Murray Ltd. 2.10.58.

Raynor Road, Fallings Park, Wolverhampton. Chemists, druggists, etc. £100.
Dirs.: J. D. and Constance McDermott and J. Murray.

B. J. V. Nicholls Ltd. 23.9.58. 495 Bath Road, Saltford, Som. Chemists, etc. £1,000. Dirs.: L. W. B. Nicholls, L. W. Goodman and C. Hemingway.

Mail The Chemists Ltd. 23.9.58. 2 St. James Avenue, London, E.2. £100. Dirs.: G. Mail and F. Mail.

J. A. Peile (Chemists) Ltd. 25.9.58. Highfield, Chiltern Hills, Chalfont St. Peter. £5,250. Dirs.: A. and Muriel Innes.

Care Laboratories Ltd. 25.9.58. Care Laboratories Ltd. 25.9.58. To market under the trade name Care toilet preparations of all kinds and to earry on bus. of perfume and cosmetic manufacturers, etc. £100. Subs.; R. H. Malthouse and G. P. G. McNair.

T. Walton (Chemists) Ltd. 30.9.58.

2A Halifax Road, Liversedge, Yorks. To take over bus. of T. Walton cd. on at historical Variation and the communication.

Liversedge, Yorks.; and to carry on bus. of chemists, druggists, etc. £2,000. Dirs.: T. and Jean Walton and A. Butterfield.

Evans Medical (Midlands) Ltd. 1.10.58. Speke, Liverpool, 24. Mfg. chemists, etc. £100. Dirs.: I. V. L. Ferguson, W. A. Kinner, C. W. Robinson and G. A. Wilson. D. Jones (Chemists) Ltd. 3.10.58. 34 Harold Road, London, S.E.9. Chemists

and druggists, etc. £1,500. Dirs.: D. Jones and D. W. Dewdney.

Station Drug Store Ltd. 3.10.58. National Avenue, Hull. £100. Dirs.: Ann Spink and Horace Sharp.

Sm.th and Nephew-Southalls Ltd. 2.6.58. Chatford Mills, Saltley, Birmingham 8. Dlrs. in, agents for and manfrs. of surgical and sanitary appliances, dressings, surgical dressings, chemists' sundries, etc. Subs.: J. Emmitt and Martin Bell.

Selby and Taylor Ltd. 3.6.58. Wembley Hill House, 11-12 Neeld Parade, Wembley Hill Road, Wembley, Middx. Chemists, herbalists, etc. £100. Dirs.: Gerald Selby and Percy Taylor.

W. E. Cane Ltd. 25.7.58. 406 Bank Chambers, High Holborn, London, W.C.1. Wholesale or retail chemists and opticians. £3,000. Dirs.: Stephen G. and Isabella W. B. Sharp.

Nigroid Ferris Ltd. 29.7.58. To acquire the rights in recipes of and carry on the manufacture of certain proprietary pre-paration known as "Nigroid"; to carry on the bus of chemists, druggists, etc. 49,900. Dirs.: A. B. James, Manilla Lodge, Clifton Down, Bristol 8, C. Shutter and A. M. McWatters.

A. Sheldon (Middleton) Ltd. 21.8.58. Prospect Quarry, Via Gellai, Wirksworth, Derby. Fertiliser suppliers, etc. £10,000. Dirs.: Albert, Dorothy E., and Eric Sheldon.

Hanworth Laboratories Ltd. 22.8.58. Hanworth Lane, Chertsey, Surrey. Manfg. chemists or druggists, manfrs. of and dlrs. in cosmetics, etc. Dirs.: Edward W. C. O'Callaghan and Maurice P. Bailey.

Pretty Cosmetic Co. Ltd. 22.8.58. Hanworth Lane, Chertsey, Surrey. £100. Dirs.: Auguste E. Baumeister, Madge K. Candelent and David A. Potkin.

Earex Ltd. 26.8.58. 48 Higher Bridge St., Bolton. Mnfrs. of and dlrs. in chemicals, drugs, etc. £100. Dir.: Mary M. Rabinson.

F. J. Hicks Ltd. 1.9.58. 34 South Molton St., London, W.1. Retail and wholesale chemists, druggists, laboratory proprs., etc. £100. Subs.: Joseph J. Jayson and Francis Geraghty.

Winifred Atwell Cosmetics Group Ltd. 27.8.58. 39/42 New Bond St., London, W.1. £20,000. Dirs.: Norman Shine, Winifred Atwell, Reginald E. G. Levisohn, Herbert G. Baker, Michael Bollin and Henry Kahan.

Magnetic Products Ltd. 28.8.58. 2 Montford Place, London, S.E.11. Research physicists, research chemists, engrs., etc. £100. Dirs.: Zoltan F. Kellerman and Steven I. Warman.

W. A. Weston Ltd. 29.8.58. 34 South Molton St., London, W.1. Chemists, druggists, laboratory proprs., etc. £100. Subs: Joseph H. Jayson and Francis

Barytes (Shielding Products) Ltd. 1.9.58. Buyers, sellers, distributors and mnfrs. of all types of metallic mineral and chemical substances useful in the preparation of shielding devices against harmful effects of radiation from radio-active sources, etc. £5,000. Subs.: John C. Gore and Alfred L. Leddings.

Alfred L. Leddiman.

M. Beetham and Son Ltd. 20.8.58.
Priory Court, London Rd., Cheltenham,
Glos. To take over bus. of manfg. chemists
and cosmeticians cd. on as "M. Beetham
and Son" at Ucal Works, Cheltenham, by
United Chemists Association Ltd. £100.
Dirs.: Frank L. Dent, Joseph L. Goulder,
Wm. T. Haigh, Bertram J. Browning and
John R. Gale.

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COTY PEACH BLOOM.—773,762. Coty (England) Ltd. MAKEUR.—777.852. Antoine Francois

Regis Peyron.
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cal Industries Ltd.
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LOMUFER.—777,695. Benger Laboratories Ltd.

LOMULIN.—777,696. Benger Laboratories Ltd.

LOMUPREN. — 777,698. Benger Laboratories Ltd. STEPIN.—777,742. Dr. Karl Thomae

STEPIN.—777,742. Dr. Karl Thomae Gesellschaft Mit Beschränkter Haftung. BAMYCAFF.—777,827. Ab Hässle, Anotekare Paul Nordströme Fahriker

Apotekare Paul Nordströms Fabriker. BAMYCOD.—777,828. Ab Hässle, Apotekare Paul Nordströms Fabriker. PHRENOPRACTIN.—778,597. Im-

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NEMBUDONNAL.—775,804. Abbott Laboratories. TABSEAL.—777,618. The Crookes

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cois Regis Peyron. NORGESTON.—778,191. Schering Aktiengesellschaft.

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804.047.

Hormones

Process for the manufacture of adrenocorticotropic hormone preparations.

Organon Laboratories. 804,639.

Steroids. Soc. des Usines Chemiques

Rhône-Poulenc. 804,480.

Steroids and the preparation thereof. C. Pfizer and Co. Inc. 804,521.

Vitamins

Stabilised vitamin A compositions. Eastman Kodak Co. 804,985.

Vitamin B₁ preparations and method of obtaining same. Parke, Davis and Co. 804.750.

Methods of producing adermin (vita-in B₆). Philips Gloeilampenfabrieken min B₆). N.V. 804 804,236.

Stabilised compositions simple synthetic vitamin A materials. Eastman Kodak Co. 804,984.

Agricultural chemicals

Methods of producing preparations for mbating weeds in flax. Philips Gloeicombating weeds in flax. Ph. lampenfabrieken N.V. 804,309.

Process for producing fertilisers and products thereof. Lummus Co. 804,292. Granular fertilisers. Scottish Agricultural Industries, Ltd. and Imperial Chemi-cal Industries Ltd. 804,053.

Preparation of an improved fungicide.

R. T. Vanderbilt Co. Inc. 804,477. Process for the preparation of fungicidal supermetallic associates and compositions containing them. N. V. De Bataafsche

Petroleum Maatschappij. 804,507.
Fungicidal compounds. Plant Protection Ltd. 804,444.

Process for the preparation of a fungicide based on ethylene-dithiocarbamates. Montecatini Soc. Generale per l'Industria Mineraria e Chimica. 805,108.

Fertilizers. Fisons Ltd. 805,160.

Ammonium nitrate and compositions ontaining same. Imperial Chemical Incontaining same. dustries Ltd. 805,112.

Pharmaceuticals and fine chemicals

Derivatives of 4-hydroxycoumarin and their production. Farbenfabriken Bayer A.G. 804,125.

Preparation of amides of lysergic acid and mixed anhydride useful in such preparations. E. Lilly and Co. 804,188.

Pharmaceutical preparations for application to the skin or the mucous membranes of the mouth. A. C. J. Opfermann. 804,230.

Process for the manufacture of 3:3:5trimethyl-cyclohexanol. Howards of Ilford

Ltd. 805,157; 805,158.

Production of sennosides from folia sennae or folliculi sennae. Byk-Gulden Chemische Fabrik 804,232

Method for preparing fatty acid esters oligosaccharides. T. Hedley and Co. of oligosaccharides. Ltd. 804,197.

Process for the manufacture of a sulphanilamide of the isoxazole series. Hoffmann-La Roche and Co. A. G. 804,036.

Process for N₁ N-diisopropylbenzothiazole-2-sulphonamide. American Cyanamid Co. 805,021.

a-Methyl-a-phenylsuccinodinitrile and a process for producing N-methyl-a-phenyl-a-methylsuccinimide. Parke, Davis and 804,456.

N-β-[cyclohexyl (or hexahydrobenzyl)aryl (or aralkyl)-aminol]-ethylpiperidines and process for their preparation. Farmaceutici Italia S.A. 804,321.

Quinuclidines and process for their manufacture. Ciba Ltd. 804,204; 804,205. Isocamphane compounds and their preparation. Merck and Co. Inc. 804,880.

Aminopyrine, caffeine or quinine hydro-chloride inclusion compounds. M. Ruben. 804,492.

Therapeutic compositions. Lambert Pharmaceutical Co. 804,084. Process for enhancing the solubility of medicines in water. Koninklijke Neder-

Gisten Spiritusfabriek N.V.landsche 805,026.

Process for producing a nitro-acetophenone. Parke, Davis and Co. 804,467. Optically active 7-carboethoxy-3acetylthioheptanoic acids and their salts.

Merck and Co. Inc. 805,296.

Dithiomalonic acid dimorpholide. Ruhrchemie A.G. 805,336.

Tropane derivatives. Sandoz Ltd. 804,837.

a, a-Dichloroisovaleric acid and its salts. Dow Chemical Co. 805,260.

Dyestuffs

Chromium and cobalt complex compounds of monoazo dyestuffs of the benzene-azo-naphthalene series. Sandoz Ltd. 805,217.

Process for preparing dye developers.

Metallic developers developers.

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Metallic developers developers. International Corporation. 804,973; 804,974; 804,975.

dyestuffs Water-insoluble of - 2 - hydroxy - 3 benzene - monoazo Farbennaphthoic acid amilide series. fabriken Bayer A.G. 804,673.

Metal containing dyestuffs of the benzene-monoazo-quinolone series. Farbenfabriken Bayer A.G. 804,766.

Phthalocyanine pigments. General Ani-

line and Film Corp. 804,031.

Disazo pigments and their use. J. R. Geigy A.G. 803,985. Copper-containing trisazo dvestuffs.

Farbenfabriken Bayer A.G. 803,810.

Miscellaneous

Apparatus for detecting carbon monovide Coal Industry (Patents) Ltd. 802.281.

Process for epoxidation of organic compounds. Johnson and Son Inc. 802,127. Inactivation of catalyst in molecular rearrangement reactions of fatty esters.

T. Hedley and Co. Ltd. 802,129. Production of organic compounds containing phosphorus and sulphur. Albright and Wilson (Mfg.) Ltd. 801,568. Process for the treatment of Glauber's

salt. Courtalds Ltd. 801,527.

Manufacture of potassium pyroanti-monate. Associated Lead Manufacturers Ltd., and W. E. Green. 801,572.

Production of glycidyl ethers. Badische Anilin-and Soda-Fabrik A.G.

Process for the preparation of desiccants and dehumidifiers. Council of Scientific and Industrial Research. 802,182.

Steam sterilisation of liquids and semi-liquids. J. J. Ciboit. 802,338.

Catalysts, a process for the manufac-ture thereof and the use thereof in a racimisation process. F. Hoffmann-La Roche and Co. Ltd. 804,788.

Process for the refinement of fatty acid esters. Noblee and Thorrl G.m.b.H. 804,022. Esters of halides of dibasic organic acids. Merck and Co. Inc. 805,297.

Derivatives of octanoic acid. Merck and Co. Inc. 805,298; 805,299; 805,300.

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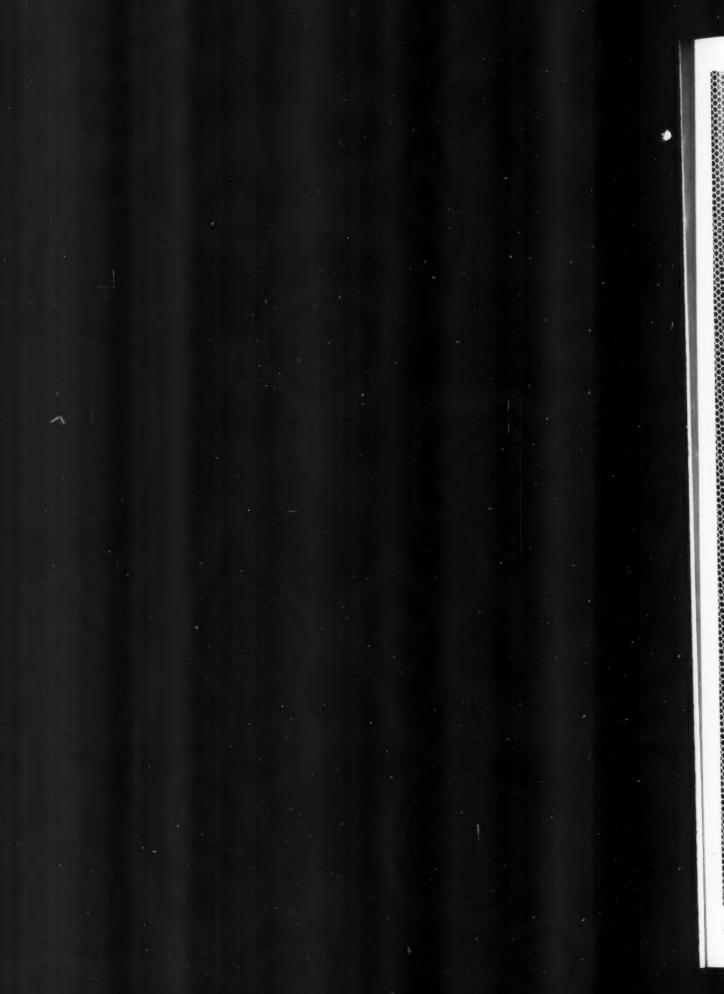
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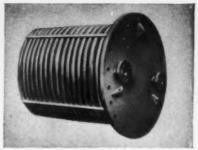
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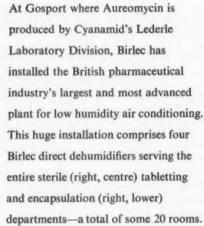
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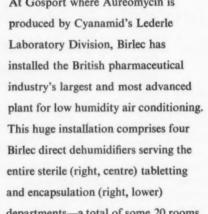
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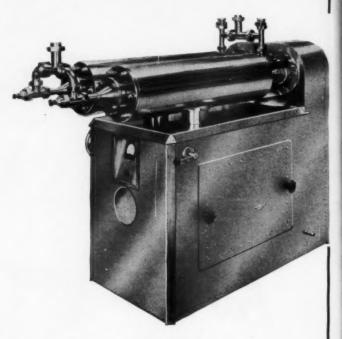
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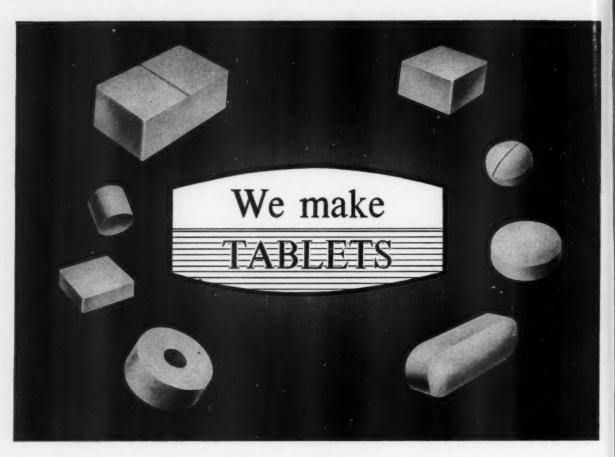
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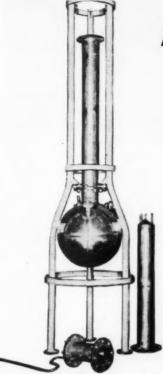
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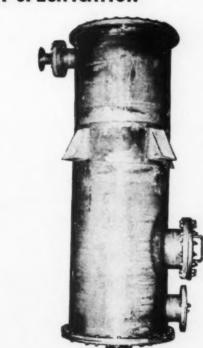
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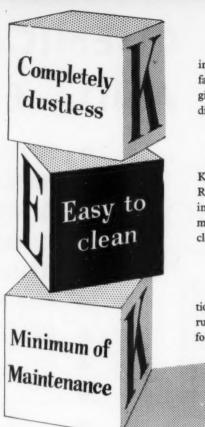
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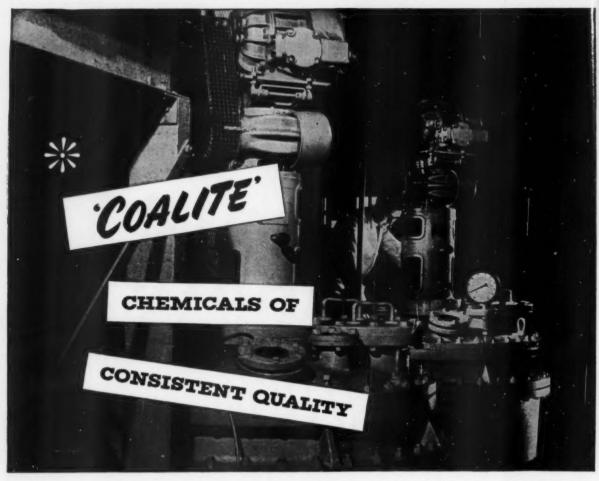
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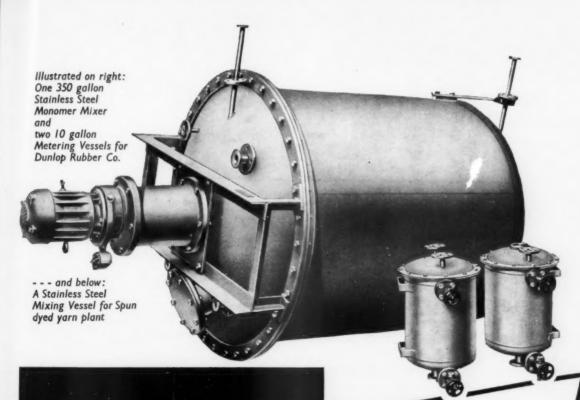
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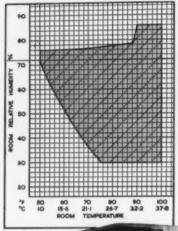
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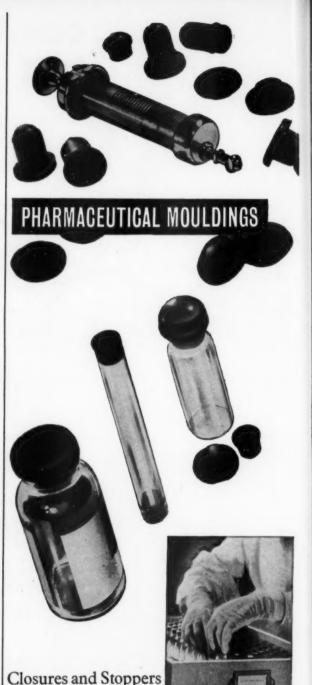
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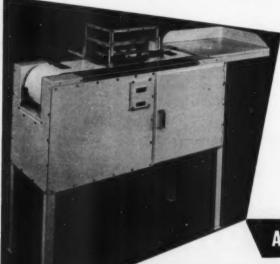
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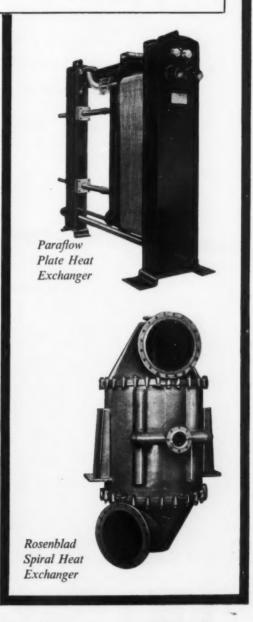
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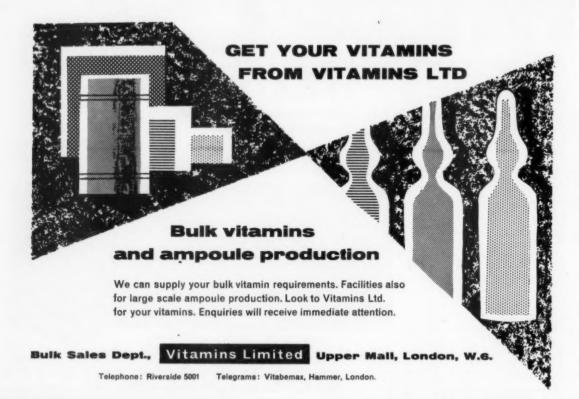
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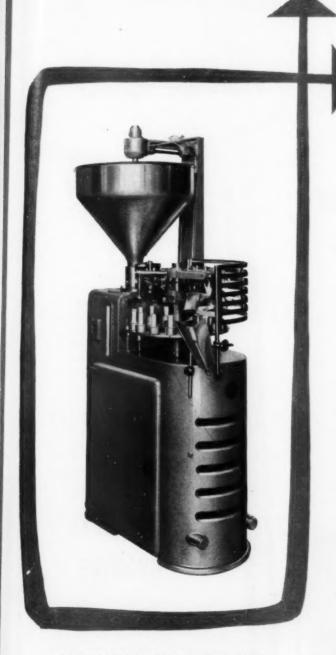
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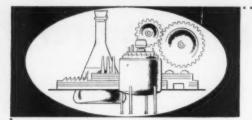
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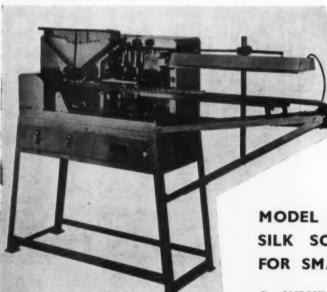
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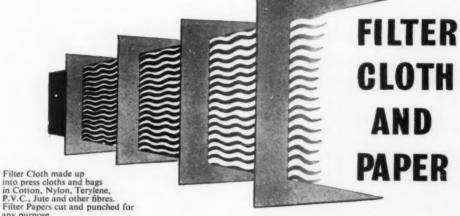
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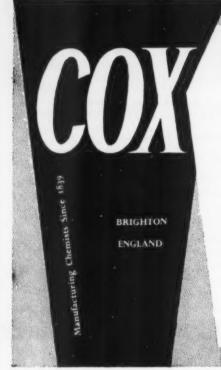
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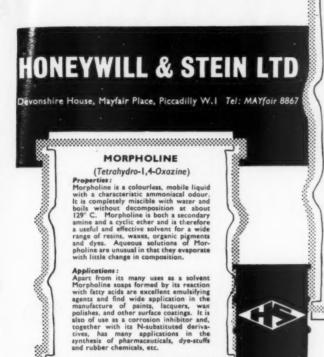
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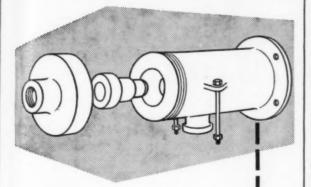
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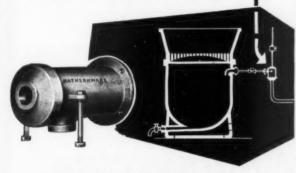
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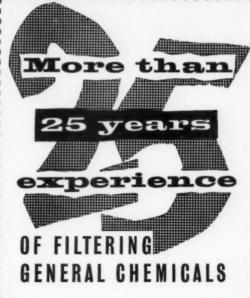
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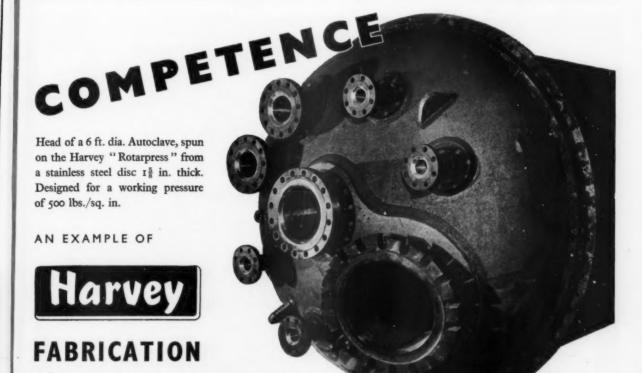
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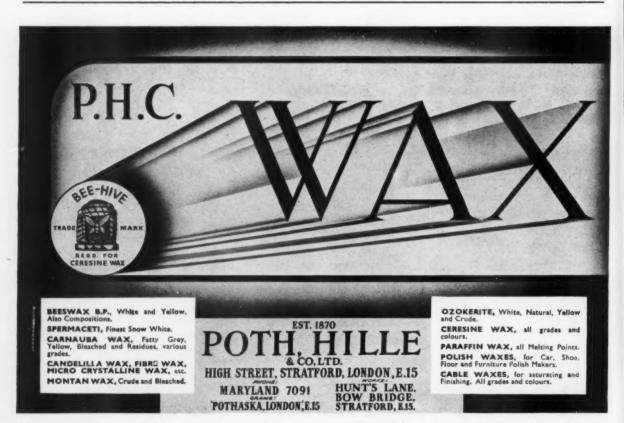
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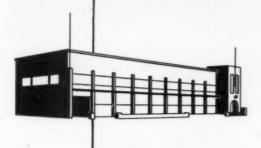
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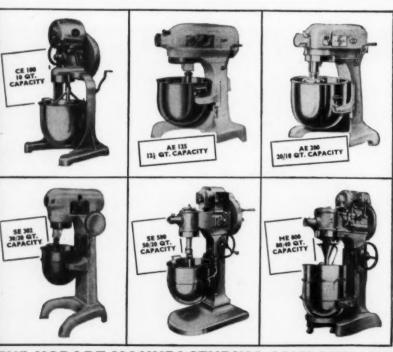
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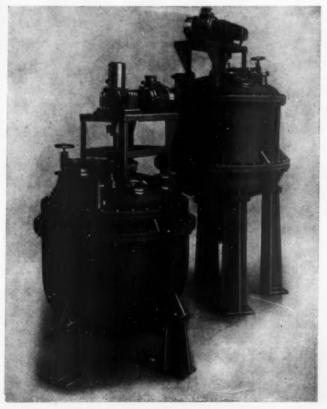
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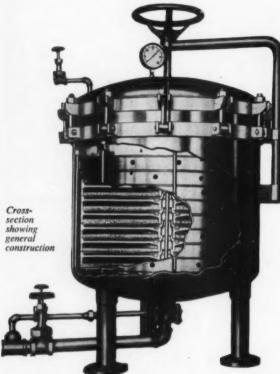
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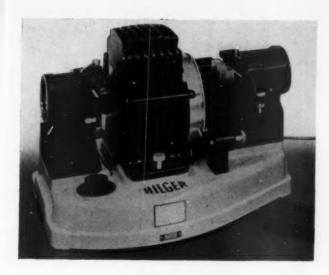
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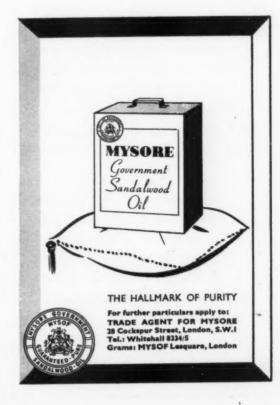
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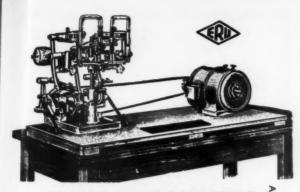
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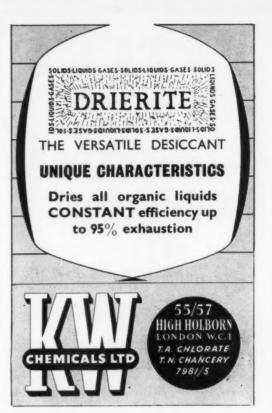


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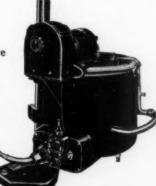
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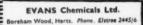
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